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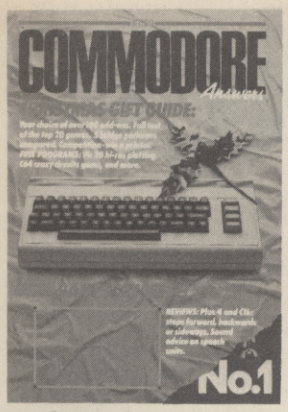

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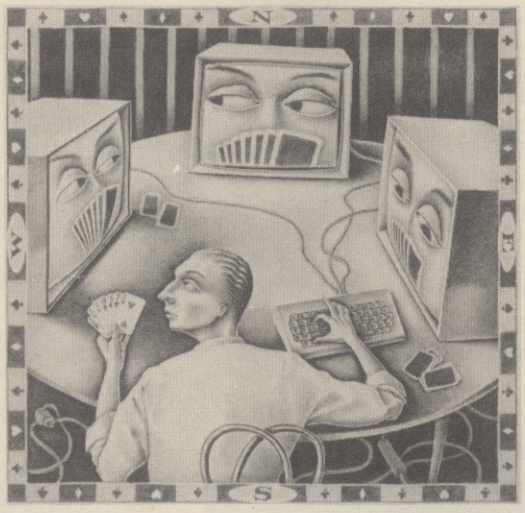

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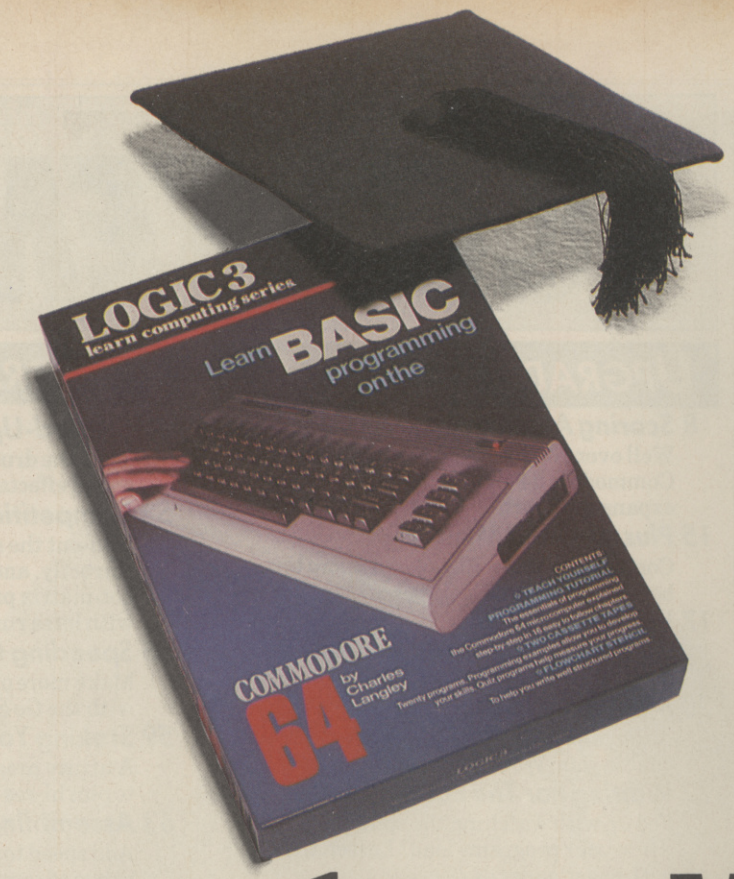

How to teach your Micro a thing or two

Thousands of home computer owners have yet to discover their microcomputer's potential to help with many of the problems and decisions that come up every day in the home or office.

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OPEN EDIT

The success of the Commodore Vic 20 and 64 has surprised many people, particularly those who judge the machines on purely technical grounds.

Criticisms can be levelled at them from a number of angles — poor Basic, slow tapes and disks, unhelpful manuals, and so on. However, both these machines have literally been sold in millions.

The main reason for this success, in our opinion, has been the relentless marketing effort that has backed them up. The push that has been behind these machines was largely due to Commodore's ex-managing director Jack Tramiel. Directors of other companies have openly stated they wouldn't like to cross with Mr Tramiel. Not a man to be messed with, it seems.

However, with Tramiel's departure to Atari, Commodore may lack the conviction to back one machine and push it into the million-seller figures. It takes a lot of guts to put an entire corporation behind one home computer, and the risks of backing the wrong horse are great.

This is where there is now some uncertainty: Commodore have just released two new computers, the Commodore 16 and the Plus/4, both reviewed in this issue. The question is, which one, or ones, are they going to throw their weight behind for 1985?

The answer is not clear. Taking the undecisive option, backing these two new ones *and* the C64 has its risks.

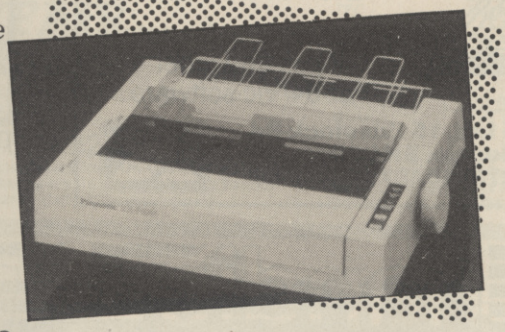
Experienced has shown that the success of a micro depends, in no uncertain terms, on the amount and quality of the software that is produced for it.

Manufacturers themselves do not have the resources to turn out quality programs on the scale neccessary for success. Independent companies must take the machine on. But software houses have become wise through bitter experience. They are not really prepared to throw their weight behind a home computer unless it looks as if it is going to sell at least one million units.

So the big question regarding the Commodore 16 and Plus/4 is, will the software houses back them?

We suspect that if Jack Tramiel was in charge, this question could be answered — at least for one machine; but, as it is, it is still open.

The size of the independent Commodore 64 market is considerable.



Our Upgrade section kicks off with an overview of what's available on the hardware front. Well over 100 products are listed (with a suitable pertinent comment, of course).

The games market is also large; we have reviewed the top 20 best sellers for the 64, and top 10 for the Vic. We hope these two sets of reviews, and our hardware upgrade table will help you select what's best for your Christmas stocking.

If you are short of a printer, we are giving one away as the first prize in our Space Shuttle competition. All it requires is a little bit of programming (well OK, a little bit of thought too).

Finally, remember our free question cards. Use these for questions, comments, flak, or whatever you want to tell us. Also, if you notice a new add-on or piece of software that you are interested in but would like to see a review of then, again, the card is the way to get your questions answered.

By Peter Turcan, editor.

As some of you will have seen from the front cover, we are giving away a free games cassette with this issue, 'Aqua' from Mastertronic; we say some, because readers who live in London will, we're afraid, have to cut out the bottom right hand corner of the cover, and send it to the address below. Sorry Londoners, but this is due to a distribution problem out of our control.
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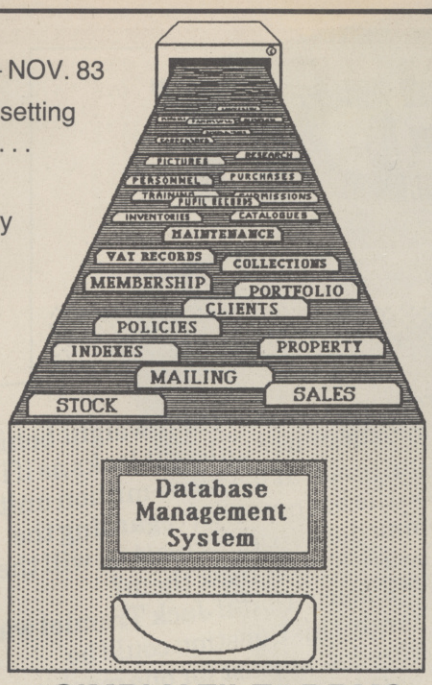

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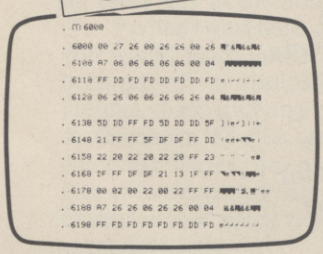

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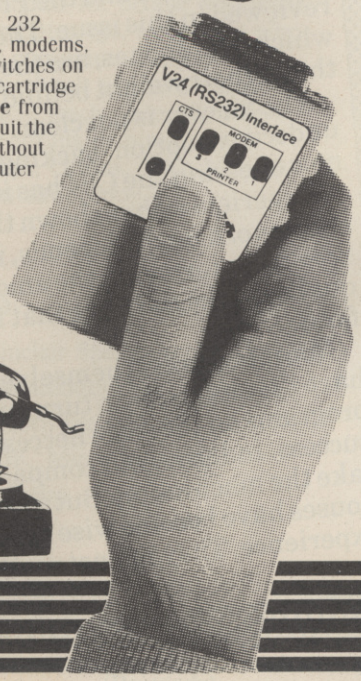

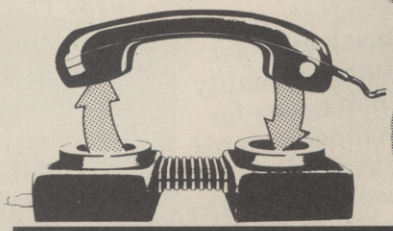

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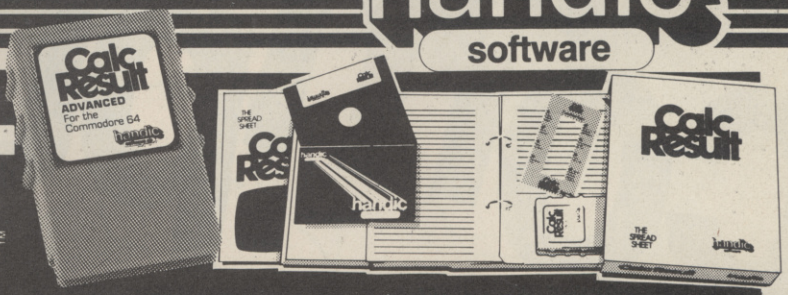

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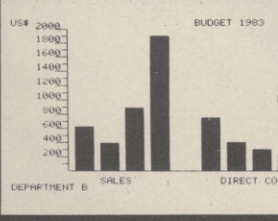

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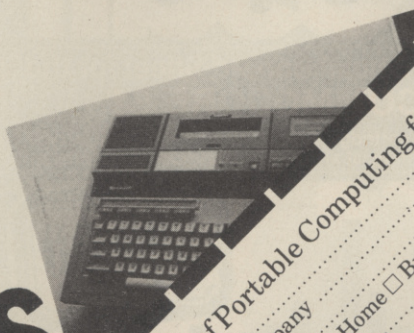

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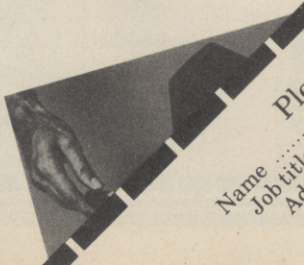

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JUST ABOUT EVERY ADD-ON YOU COULD WANT FOR YOUR VIC OR 64—AND WHERE TO GET 'EM.

Despite the fact that Commodore itself make a range of peripherals for their micros (partly for market-monopolising reasons, partly because of their policy of selling a 'whole product'), a large number of independent manufacturers have produced their own hardware for the Commodore 64 and Vic 20.

As well as add-ons that Commodore simply does not cover, the alternative varieties often provide facilities which the 'home produced' ones do not have — and at a cheaper price.

We set out to capture details of 100 of 'em, and present them in a short concise form. This should, we hope, be of interest to anyone considering expanding their 64 or Vic. Reviews of some of these products appear in various other articles in this issue, but we have also added cross references where possible, and a little pertinent comment, just to spice things up.

By Steve Applebaum, staff-writer.

COMMODORE MICROS

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Plus/4	£299.00	**Commodore**	60K user RAM, excellent sound and 121 colours.
Commodore 16	£140.00	**Commodore**	16K, two joystick parts, four cursor keys, and 12 colours.

JOYSTICKS

Joysticks are an obvious advantage for games playing and design. Both the Commodore 64 and Vic20 use a nine-pin 'D' socket. This is now standard, and there is a wide range of digital and analog units available.

A digital joystick will be enough for most Commodore owners, but an analog type is far better for the user interested in design work.

Digital joysticks normally rely on micro switches, so the only movements they register are: up, down, left, right, and diagonals. The analog type of joystick, on the other hand, uses increases in voltage to determine how far a cursor is moved. This system makes the joystick much more accurate.

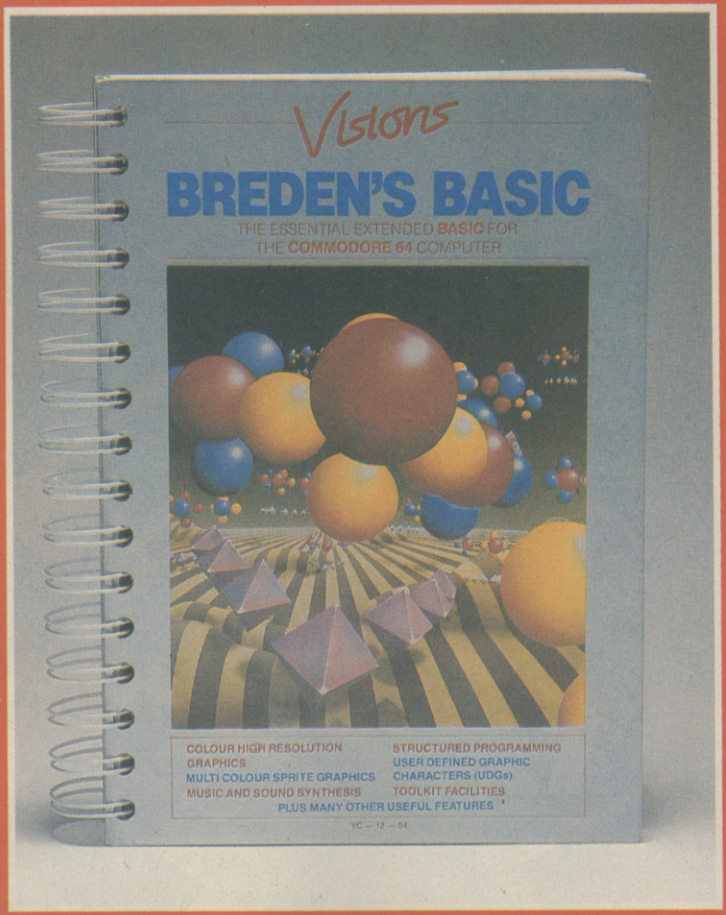
Commodore 64 and Vic 20:

Atari Joystick	£6.99	**Atari International**	Diagonal movement restricted.
Cambridge Joystick	£7.90	**Cambridge Computing**	Analog, with two fire buttons.
Commodore Joystick	£7.50	**Commodore**	Firing not always reliable.
Commodore Paddles	£13.50	**Commodore**	Sail away to a high score.
Starfighter Joystick	£13.95	**Consumer Electronics**	Compact and practical.
TAC 2	£18.95	**Consumer Electronics**	Tacky, but accurate.
Joy Sensor	£29.95	**Consumer Electronics**	Must be treated gently.
Aerobic Joystick	£35.95	**Consumer Electronics**	For overweight arcarders only.
Sure Shot	£15.95	**CCS**	Accurate, neat, and comfortable.
Triga Command	£19.99	**Datel Electronics**	For would-be helicopter pilots.
Quickshot Joystick 1	£9.99	**dk'tronics**	Suckers keep joystick stable.
Quickshot Joystick 2	£12.95	**dk'tronics**	Good grip, trigger fire button.
Arcade	£15.00	**Dynamics Marketing**	Uses rubber feet for support.
Arcade Professional	£38.50	**Emax Computing**	Arcade type design.
Pro 1000	£10.99	**Kempston Micro**	One of the first, and best.
Pro 3000	£12.75	**Kempston Micro**	Has three fire buttons.

ILLUSTRATION BY MISS MOSS

NEW FROM *Visions*

BREDEN'S BASIC



The **ESSENTIAL EXTENDED BASIC** for the Commodore 64 incorporating **HIGH RESOLUTION COLOUR GRAPHICS, STRUCTURED PROGRAMMING TECHNIQUES, MULTI-COLOUR GRAPHICS, USER DEFINED CHARACTER GRAPHICS, MUSIC** and **SOUND SYNTHESIS** and **TOOLKIT FACILITIES** plus many other useful features.

BREDENS BASIC has more commands (135) for the programmer to use than any other **EXTENDED BASIC** currently available, and drives the **SOUND** and **GRAPHIC** chips to their fullest extent short of writing in **MACHINE CODE.**

BREDENS BASIC is from **VISIONS** and as with all our products we've created a well written and **USER FRIENDLY PROGRAM** which is, the **MOST COMPREHENSIVE BASIC** yet available for the Commodore 64. Using **BREDENS BASIC** can only enhance the Commodore 64's versatility and its programmers ability.

BREDENS BASIC comes with both disk and tape, offering the user the facility to upgrade at such time as he acquires a disk drive. Running in **LESS THAN 8K BREDENS BASIC** allows plenty of room for program development with a **HIGHLY COMPREHENSIVE** and **EASY TO USE MANUAL** with a set of **HELPFUL HINTS** in the appendices. The **USER REGISTRATION DOCUMENT** enables us to update your software as and when Visions brings out new releases. **BREDENS BASIC** offers **GREAT VALUE FOR MONEY (39.95), A HIGHER DEGREE OF VERSATILITY** and **TREMENDOUS USER FRIENDLINESS.**

All in one **GREAT EASY TO USE PACKAGE.**

Visions Bredens Basic comes with a 180pp easy to use manual plus disc and cassette in a presentation box.

Available from leading stockists including Boots and W H Smiths or direct from address below. CMA1

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SUITE 38, STRAND HOUSE,
GREAT WEST ROAD, BRENTFORD.
MIDDX. TW8 9EX 01-560-4191

Unit:	Cost:	Company:	Comments:
Pro 5000	£13.50	**Kempston Micro**	One of the best.
Lightning Joystick	£4.75	**Lightning Records & Video**	Has suckers and two fire buttons.
Pointmaster Pro	£14.95	**Silica Shop**	Gives you that winning way.
Wico Red Ball	£27.95	**Silica Shop**	Accurate, but non-slip feet about as useful as a new pair of leather-soled shoes.
Wico Straight Stick	£21.95	**Silica Shop**	Accurate and a lot to grab.
Analog Joystick	£15.00	**Stack 100**	Very accurate, and very sensitive.
Pro Ace	£12.95	**Sumlock Microwave**	Good response; bad grip.
Delta 14	£12.95	**Voltmace**	Has 14 user-definable keys.
Delta 5C	£10.00	**Voltmace**	Sensitive and quick responding.

LIGHT PENS

Light pens are a reasonable alternative to joystick for doing design, or for choosing items from menus. By touching a spot on the screen with the pen, a picture can be made to appear, or an option selected.

Most of the light pens on the market have programs written for them which allow the user to draw circles, fill in shapes, and draw lines, for example.

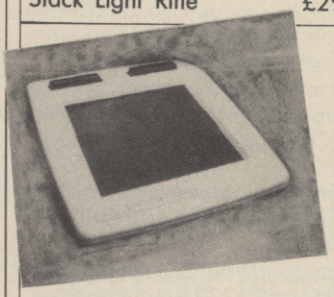
Some, such as the Stack light pen, have games written for them.

Commodore 64:			
Pixstik	£29.95	**HCC**	Includes *Paintbox* + three games.
Stack Light Pen	£28.00	**Stack 100**	Plenty of software available.
Light Pen	£17.25	**Trojan**	Resembles a Bic biro.
Vic 20:			
Pixstik	£29.95	**HCC**	Includes *Paintbox* + three games.
Stack Light Pen	£28.00	**Stack 100**	Requires 16K memory.
Light Pen	£19.95	**Stonechip Electronics**	Works like the others.

LIGHT RIFLE

A light rifle is comparable to a light pen, its use obviously being limited to specially written arcade games.

Stack Light Rifle	£29.95	**Stack 100**	Plenty of compatible software.



TOUCH PAD

Touch tablets are like small writing slates which, when written on, send the image to the micro and so to the screen. It is, in effect, a unit which allows hi-res pictures to be drawn without the need of having to write a program. Some touch tablets such as the Koala, are controlled entirely from the tablet, others require some keyboard input. By moving a cursor around a menu, several drawing options can be selected, giving the inexperienced user quite good use of the graphics capabilities of the machine.

Commodore 64:			
Grafpad	£143.75	**British Micro**	Includes drawing pen and software.
Koala Pad	£79.95	**Commodore**	Relieves 'bear' screens (geddit?)
Touchmaster	£149.95	**Touchmaster**	Responds if you touch it in the right place.
Vic 20:			
Touchmaster	£149.95	**Touchmaster**	As above.

SPEECH UNITS/SOFTWARE

Speech units make a computer talk — or at least they cause it to make sounds resembling speech. Some can manage little more than a Neanderthal grunt.

Most speech units make use of allophones. These are short sounds which, collectively, form human speech. Linguists reckon there are only 64 allophones, so be wary of the 'unlimited vocabulary' claims made by some companies. Most of the speech units in our table are hardware add-ons, but Big Mouth is only software, offering almost the same facility, at a much lower price.

Commodore 64:			
Type and Talk	£171.35	**Cambridge Microcomputer**	Talks as you type.
Andor	£30.00	**Home Computer Centre**	Another speech unit.
Magic Voice	£49.99	**Commodore**	The best, and sexiest voice.
Speech 64	£29.95	**Currah Computer Components**	A tried and tested winner.

▶

Access Computer Co,
The Computer Centre,
Stockport,
SK3 8BH.
Tel: (061) 477 6013.

Adman Electronics,
Ripon Way,
Ripon Road,
Harrowgate,
N. Yorks, HG1 2AU.
Tel: (0423) 62642

Atari,
Atari House,
Railway Terrace,
Slough.
Tel: (0753) 33344.

British Micro,
Penfold Works,
Imperial Way,
Watford,
Herts.
Tel: (0923) 48222.

CCS,
14 Langton Way,
London, SE3 7TL.

Chromasonic,
48 Junction Road,
Archway,
London, N19 5RD.
Tel: (01) 263 9493/9495.

Commercial Products,
11 Hylands Close,
Furnace Green,
Crawley,
Sussex, RH10 6RX.

Commodore,
1 Hunters Road,
Weldon,
Corby,
Northampton, NN17 1QX.
Tel: (0536) 205252.

Computerama,
59 Foregate Street,
Stafford.
Tel: (0785) 41899.

Consumer Electronics,
Failsworth,
Manchester.
Tel: (061) 682 2339.

Currah,
Graythorpe Industrial Estate,
Hartlepool,
Cleveland.
Tel: (0429) 72996.

Datel Electronics,
Unit 8,
Fenton Industrial Estate,
Dewsbury Road,
Fenton,
Stoke-on-Trent.
Tel: (0782) 273815.

dk'tronics,
Unit 6,
Shire Hill Ind Est,
Saffron Walden,
Essex.
Tel: (0799) 26350.

Dynamics Marketing,
Unit 15,
Colling Close,
Irlam,
Manchester.
Tel: (061) 775 1827.

Emax Computing,
Pinfold Lane Ind Est,
Bridlington,
N. Hants.

Glanmire Electronics,
Westley House,
Trinity Avenue,
Bush Hill Park,
Enfield, EN1 1PH.
Tel: (01) 366 3245.

HCC,
29 Millcroft,
Crosby,
Liverpool, L23 9XJ.
Tel: (051) 727 8050.

HMV (The Computer Dept).
363 Oxford Street,
London, W1.
Tel: (01) 629 1240.

Impex Designs (UK),
Metro House,
Second Way,
Wembley,
Middx, HA9 0TY.
Tel: (01) 900 0999.

Jamar,
17a Station Rd,
Mirfield,
W Yorks.

JCB,
29 Southbourne Road,
Bournemouth.
Tel: (0202) 423973.

JRS Software,
19 Wayside Avenue,
Worthing, BN13 3JU.
Tel: (0903) 63902.

Kempston Microelectronics,
Unit 30,
Singer Way,
Woburn Road Industrial Estate,
Kempston,
Bedfordshire.
Tel: (0246) 850357.

Maplin Electronic Supplies,
PO Box 3,
Rayleigh, Essex.
Tel: (0702) 552911.

Unit:	Cost:	Company:	Comments:
Commversa	£19.99	**Datel Electronics**	Plug in and go.
Speakezy	£29.95	**JCB Microsystems**	Has almost 200 pre-defined words.
Big Mouth	£7.95	**Evesham Micro Centre**	Add speech with SPEAK command.
SAM	£57.32	**Tronix**	Disk-based speech.
Chatterbox	£44.85	**William Stuart Systems**	N-ot t-oo ba-d.
Speakeasy	£34.95	**Jamar**	
Vic 20:			
Speech Synthesizer	£29.95	**Adman Electronics**	Plugs into the Vic's rear.
Talkback (kit)	£22.95	**Maplin**	64 allophones build words.

RAM PACKS

RAM packs are additional random access memory, something that the Vic 20 is desperately in need of. (The Commodore 64 needs no additional memory, and complete with the maximum possible 64K of RAM.) The standard Vic 20 comes with only 3.5K of user memory, but since most games require at least 8K, additional memory is a must for this machine.

Some RAM packs, such as the one from Stonechip Electronics, are switchable, which means that you can choose between 3K, 8K, and 16K of additional memory by moving a switch, and so doing away with the need for several RAM packs.

Vic 20:			
16K Switchable RAM Pack	£35.95	**HCC**	Switchable between memory sizes.
32K Switchable RAM Pack	£49.95	**HCC**	Same, but with bigger memory.
64K RAM Pack + 2K EPROM	£64.35	**HCC**	Has room for an EPROM.
Vixen RAM Cartridge	£39.95	**Stonechip Electronics**	Gives 3K, 8K, and 16K.
32K Switchable RAM pack	£39.95	**Zero Electronics**	Allows up to 32K RAM.
64K RAM + 2K EPROM	£73.50	**Zero Electronics**	Enables use of all file handling.

PRINTERS

Printers are a must for lasting copies of program listings, letters, memos, or whatever. But buying a printer for either the Commodore 64 or Vic 20 can be real headache.

The problem is that very few printers, apart from those manufactured by Commodore, print out the special Commodore graphics characters without modification or special written software.

Another hassle with buying a printer (again, apart from Commodore's) is that it will require an additional interface, either an RS232 interface or Centronics interface. This is because Commodore has only equipped its machines with a serial part.

MPS-801	£230.00	**Commodore**	Dot matrix printer (50cps).
MPS-802	£345.00	**Commodore**	Dot matrix printer (60cps).
MCS-801	£399.99	**Commodore**	Dot matrix colour printer (38cps).
DPS1101	£399.99	**Commodore**	Daisy wheel (18cps).
Commodore 1520	£169.99	**Commodore**	Economy printer/plotter (14cps).
64/Vic-to-Centronics cable	£19.95	**Chromasonic**	A kind of OUTPUT translator.

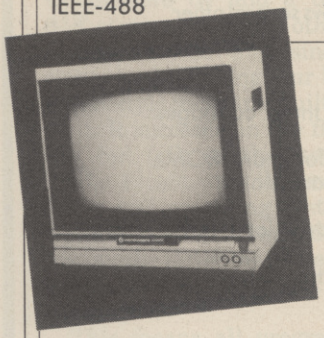
PRINTER INTERFACES

As mentioned above, printer interfaces are a must for those who want to use any printer other than Commodore's own.

In general, the best interface is a Centronics type, because unlike the RS232, it requires no fiddling about with wires and pins. However, unlike the RS232, a Centronics interface cannot be used for other devices.

Vic 20 and Commodore 64:			
RS232 Printer Interface	£34.95	**Access Computer**	Links Vic 20/64 to serial printer.
Superbox 64	£94.95	**Chromasonic**	Includes a 'real' IEEE.
Centronics Interface	£28.50	**JRS Software**	Allows many printers to be used.
RS232 Interface	£54.65	**Impex Designs**	Compatible with any RS232 printer.
MW-350 Graphics Interface	£89.95	**Impex Designs**	Enables any Centronics printer to print Commodore graphics.
MW-302C Interface	£66.95	**Implex Designs**	Passes all normal characters, but not Commodore graphics, to printer.
The Grappler	£120.75	**P & P Micro Distributor**	Not a wrestler, just an interface.

Unit:	Cost:	Company:	Comments:
Centronics Interface	£24.00	**Stack 100**	Better results from any Centronics Printer.
RS232C	£33.00	**Stack 100**	Useful for teletypes, printers, modems, and so on.
IEEE-488	£60.00	**Stack 100**	An industry standard.



MONITORS

The Commodore, like many home computers, changes or 'modulates' the picture it produces into a TV signal, and then your home standard domestic TV set changes or 'demodulates' it back again. If you fed the computer produced picture directly to the TV tube, you would get a much clearer picture, and that's essentially what a monitor set does.

The monitor signal is also called a Red-Green-Blue signal, or RGB for short, since those are the three main colours in the cathode ray colour tube.

Apart from giving better displays for word-processing and spreadsheet packages, some users feel that a monitor reduces eye strain.

Commodore 1701	£230.00	**Commodore**	In the picture — at a price.

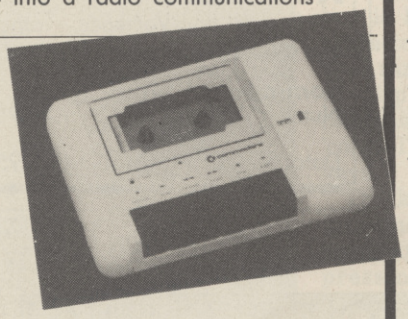
COMMUNICATIONS

Communications is a relatively new area for the Commodore 64. With the new modem and 'comms' boards that are now becoming available, the user is being given the opportunity to dial up other users, via the computer.

Commodore 64:

Communications Modem	£99.99	**Commodore**	Link up to Compunet.
COM-IN 64	£125.00	**Zero Electronics**	Turns a 64 into a radio communications terminal.

DATA STORAGE DEVICES



If you have ever written a program that you were really proud of, no doubt you wanted to hang on to it. There are various ways of doing this, the most widely used being cassette and disk storage.

Unlike the BBC, Commodore machines do not use a standard Schugart disk-drive interface so there are very few drives available, apart from Commodore's own. Anyone who has ever used these will know just how slow they are.

Another drawback is the use of a non-standard disk format. However, the good news is that Commodore's data recorders are very reliable and efficient.

Disk Drives:

Commodore 1541	£229.00	**Commodore**	Slow and bulky.

Data Recorders

Commodore 1530	£44.95	**Commodore**	For Commodore 64 only.
Commodore 1531	£44.95	**Commodore**	Cassette unit for C16 and Plus/4.

CASSETTE INTERFACES

Commodore 64:

Tape Interface	£13.99	**Glanmire Electronics**	Frees you from Commodore's expensive Data Recorder.
Cassette Interface	£15.95	**JRS Software**	As above.
Cassette Interface	£9.95	**Sevens**	As above.
Cassette Interface	£14.95	**Stonechip Electronics**	As above.

80-COLUMN CARDS

One of the Commodore 64's, and to a lesser extent one of the Vic 20's, biggest drawbacks for business users, is the lack of an 80-column display. This is an obvious necessity for such tasks as word processing, and is also a must if you are thinking of upgrading to the CP/M standard.

Commodore 64:

Textview 80-column screen	£59.95	**Impex Designs**	Gives a full-size screen display.
VIP 80-column Smart Terminal	£49.95	**Impex Designs**	Turns a 64 into a smart terminal.

Vic 20:

40/80-column card	£64.35	**Zero Electronics**	Gives 40 or 80 columns, instead of the usual 22.
80-column card + word-processor	£82.50	**Zero Electronics**	Gives 80 columns which can be mixed with hi-res screen. ▶

Microcentre,
30 Dundas Street,
Edinburgh.
Tel: (031) 556 7354.

P & P Micro Distributors,
New Hall Hey Road,
Rossendale,
Lancs, BB4 6JG.
Tel: (0706) 212321.

SCI (UK),
12 High Street,
Petersfield,
Hants, GU32 2JG.
Tel: (0703) 68521.

Silica Shop,
Dept PCW 0984,
1-4 The Mews,
Hatherley Road,
Sidcup,
Kent, DA14 4DX.
Tel: (01) 301 1111.

Stack 100,
290/298 Derby Road,
Bootle,
Liverpool, L20 8LN.
Tel: (051) 933 3355.

Stonechip Electronics,
Unit 9,
The Brook Industrial Estate,
Deadbrook Lane,
Aldershot,
Hants.
Tel: (0252) 318260.

Sumlock Microwave,
Royal London House,
198 Deansgate,
Manchester, M3 3NE.
Tel: (061) 834 4233.

Touchmaster,
PO Box 3,
Port Talbot,
West Glamorgan.

Trojan Products,
166 Derlywn,
Dunvant,
Swansea, SAZ 7PF.
Tel: (0792) 205491.

Voltmace,
Park Drive,
Baldock,
Herts, SG7 6EH.
Tel: (0462) 894410.

William Stuart Systems,
Quarley Down House,
Cholderton,
Nr Salisbury,
Wilts, SP4 0DZ.
Tel: (098) 064235.

Zero Electronics,
149 King Street,
Gt Yarmouth.
Tel: (0493) 2023.

MOTHERBOARDS

Motherboards are useful if you intend to expand your computer by more than one RAM pack. All a motherboards is, is a printed circuit board with edge connectors on it that allows several other boards to be plugged in. All this then attaches to the rear of your micro.

Unit:	Cost:	Company:	Comments:
Commodore 64:			
3-Slot Switched Motherboard	£18.95	**Impex Designs**	Holds up to three cartridges.
ROM Expansion Board	£15.95	**Impex Designs**	More room for more ROMs.
Stack 4-Slot Motherboard	£38.00	**Stack 100**	Adds four extra slots.
Expansion unit with two slots	£9.15	**Zero Electronics**	Adds two extra slots.
Expansion unit with five slots	£42.50	**Zero Electronics**	Adds five extra slots.
As above minus PSU	£37.50	**Zero Electronics**	As above.
Vic 20:			
Stack 4-slot Motherboard	£38.00	**Stack 100**	Adds four extra slots.
Expansion unit with two slots	£9.15	**Zero Electronics**	Adds two extra slots.
Expansion unit with five slots	£34.45	**Zero Electronics**	Adds five extra slots.
As above, minus power unit	£32.15	**Zero Electronics**	As above.

KEYPADS

The keypad, from Voltmace, is rather an anomaly as far as Commodore add-ons are concerned. It gives the user an extra numeric pad to speed up the keying in of numbers.

Commodore 64:			
Numeric Keypad	£28.95	**Commercial Products**	Simply for entering numbers.
Datapad 16c	£29.95	**Voltmace**	As above.

the new name in Software!

Superb software for
ORIC-1/ATMOS, COMMODORE 64,
SINCLAIR ZX-SPECTRUM, AMSTRAD, MSX

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Program Authors: Send us your latest software for evaluation and perhaps make your fortune!

Orpheus Ltd., The Smithy, Unit 1, Church Farm,
Hatley St. George, Nr. Sandy, Beds.
Tel: Gamlingay (0767) 51481

PLUS/4

Commodore's new Plus/4 has something of a split personality. On the one hand it's a home micro with a much better version of Basic than the Commodore 64 and a true 64K of memory; on the other, it tries to be a business computer by having four business style programs built in to it. It succeeds on the first bid, but fails on the last.

The Plus/4 uses the same Basic and operating system as baby brother Commodore 16, but the latter (as its name suggests) has only 16K of memory.

This means all programs written for the Commodore 16, be they in Basic or machine code, will work on the Plus/4. Of course, programs written to use the Plus/4's 64K of memory will not work on the Commodore 16, so the software is upwards compatible only.

Much of this software is likely to be in cartridge format because of the tiny amount of memory left free on the Commodore 16 when using graphics. The two machines have identical cartridge slots, so they can use the same cartridges.

Indeed, they share many of their other add-ons, including disk drive, printers and joysticks. The joysticks on the new Commodores do not have the same fitting as the old and popular Commodore/Atari joysticks, so Plus/4 owners will have to buy new joysticks from Commodore.

Commodore has always tried to make money by selling its own brand add-ons to Commodore owners, rather than have them buy from independent companies. The company is asking £45 for the cassette recorder for the new machines.

Any Commodore 64 or Vic 20 owners upgrading to the Plus/4 will be annoyed to discover the new machines use a different socket, so they will have to buy a second cassette recorder from Commodore.

Thus the minimum cost of owning a viable Plus/4 is £345, with cassette. This is expensive, being more than the MSX micros, and not far short of the £400 Sinclair QL.

The Plus/4 keyboard is well made and should stand up to lots of punishment, although only the slightest pressure is needed to depress the keys, which causes trouble for some users.

Both the case and keyboard are new designs and they are quite stylish, although there is still a bulky mains transformer to plug into the micro.

On the whole the keyboard is well thought out. Some of the symbols which are used a lot by computer enthusiasts, such as +, –, =, *, /, £, and @ are given their own keys, rather than cramming pairs of them onto one key, which saves using the 'shift' key so often.

Also, rather unusually, the micro has two 'control' keys, one each side of the keyboard. The cursor keys are in the shape of arrows, an interestingly eccentric touch.

When the machine is turned on, it produces only capital letters. If the letter keys are pressed while the 'shift' key is held down, graphics characters are produced. A wide range of characters can be displayed by typing in combinations with the 'shift', 'control' and 'Commodore' keys.

The keyboard is switched into a mode where it produces small and capital letters by pressing the 'shift' and 'Commodore' keys at the same time.

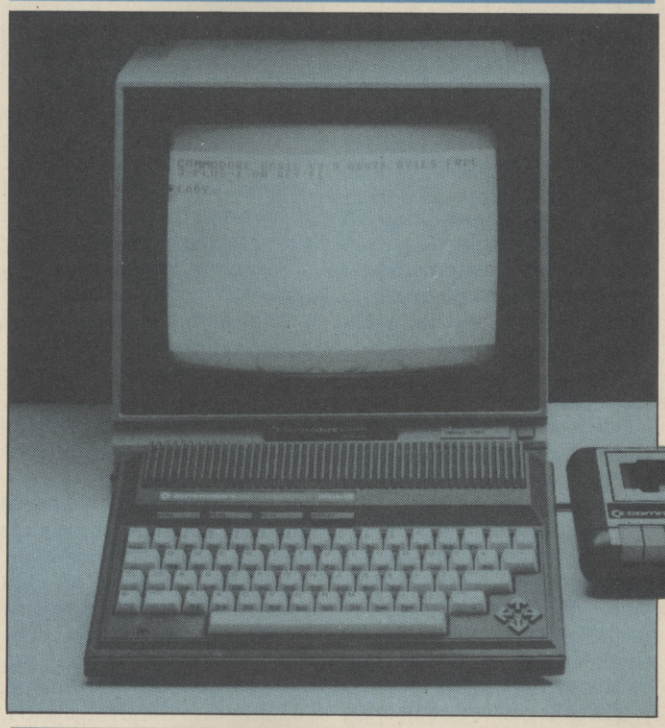
There is a shift lock key, but this is virtually unusable because so many special functions are produced by pressing a key while holding the shift key down.

There is a total of 67 keys on the Plus/4, four of which are function keys above the main keyboard. These can be programmed to hold commands up to 128 characters long. By using the shift key, another four functions can be produced.

It is easy to program these keys, but to save a little trouble the machine automatically loads commonly used commands into the keys whenever it is turned on. Seven of these are Basic commands, but one calls up the built-in word processing program.

The four 'serious' programs

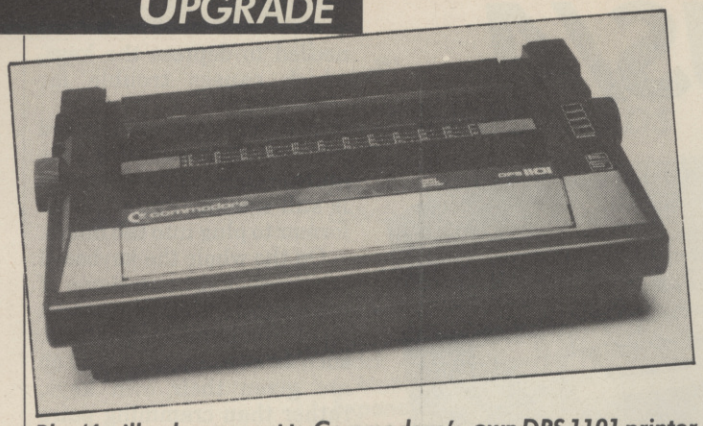
CAN THE NEW PLUS/4 ESTABLISH ITSELF AS BOTH A 'FUN' AND A 'SERIOUS' MACHINE?



PLUS/4 SPECIFICATIONS

Price: £300 (data recorder £45).
CPU: 7501.
ROM: 32K (Basic version 3.5).
RAM: 60K (less using graphics).
Screen: 320 x 200 with two colours per character; 160 x 200 with four colours per character (from choice of 121 colours); 40 x 25 characters text.
Keyboard: 67 key typewriter-style.
Interfaces: 6-pin DIN serial; 7-pin cassette I/O, User port; cartridge (expansion) port; Two joystick sockets (non-standard); Video & TV outputs.

WITH SOFTWARE SUPPORT, PLUS/4 COULD PROVE A SUCCESS.



Plus/4 will only connect to Commodore's own DPS 1101 printer.

included in the Plus/4 — a word-processor, spreadsheet, business graphics program, and database — sound good, and will help sell the micro to the uninitiated. Unfortunately, they are little short of being a disaster. The programs can't be used fully without a disk drive, putting the cost of the minimum system up to £530 (£575 with cassette). The word-processor and graphics programs are poor, and the other two are little better.

There are two ways to do a screen display for a word-processor on a home micro: one is to design the screen display to keep the program simple; the other is to make the screen display look just as the final printout will.

The Plus/4 word-processor gets caught between the two and gets the worst of both worlds. The micro's screen display is only 40 columns wide, but the software tries to simulate a 77 column screen (the width of a typical printout) by scrolling sideways as text is typed in. When the last column is reached the screen jumps back to the begining.

Getting the width right is about as far as the program goes in making the screen match the final printout. It does not even word-wrap on screen, so the first half of any word which does not fit on the end of a line will be left there, while the second half will be on the next line.

Because the screen jumps 40 columns sideways, when the end of a line reached, it is not even possible to see the two halves of the word at the same time, making mistakes hard to spot.

Several other features are just as irritating; for example, the maximum length of document the program can handle is 99 lines, not enough to write a decent letter, let alone a book.

The spreadsheet is little better. The major drawback is it can only show three columns by 12 rows on the screen at once. A novel feature is an option to have the word-processor and spreadsheet on screen at the same time, so that figures can be taken from the spreadsheet by someone writting a report. It is easy to switch back and forth between the two programs.

All the graphics program does is translate a set of figures from the spreadsheet into a simple graph made up of characters in the word-processor. The word-processor can be used to display it or print it out. Because the graph is made up from character blocks, rather than hi-res graphics, fine detail cannot be seen.

The database program records a standard format for each database on to a blank disk. All entries are then recorded in the spaces left for them (using one disk per database).

There is no way to use the database without a disk drive. It is possible to key-in text to the word-processor or create a spreadsheet without one, but the only way to save the results is on disk. There is little point in using the programs if the results cannot be saved, so Commodore must expect all Plus 4 owners to buy disk drives – sneaky.

The software is likely to disappoint unwary buyers. They will find themselves unable to use it properly if they don't have a disk drive. If they do, they will find the quality is low.

The option of disk drives for the Plus 4 is good to have, although the Commodore disk drives are absurdly slow. However, a faster working drive is being developed to plug into the cartridge slot.

Other software built into the machine rates much better than these 'serious' programs. It has a good machine-code monitor, called Tedmon, to help develop machine code programs.

Commodore's biggest triumph, however, is with the Basic language. This is an up-to-date version of Microsoft Basic, and is on a par with MSX Basic and Sinclair's Superbasic, and a long way ahead of virtually all other home micros.

The Basic is a little on the slow side, being slower than that of the Commodore 64 — under half the speed of the BBC Micro and only a little faster than the Spectrum. Its speed can be increased by about a third by POKEing a memory location which turns the screen display off.

The Commodore 64 lacks all graphics commands — the Plus/4 has some of the best around. Its CIRCLE command is followed by no fewer than nine parameters. If only four of them are specified, circles are drawn. By adding more parameters, the command will produce ovals and arcs. These can be rotated so their axes lie in any direction.

The last option allows the command to draw polygons such as triangles, squares, pentagons, hexagons, and so on. The BOX command makes it easy to draw rectangles, either in outline or in solid colour, and these can also be rotated to any angle. The PAINT command fills any outline shape with solid colour.

Like the Commodore 64, the Plus 4 has a graphics resolution of 320 dots. Unlike the 64, it can show 121 different colours on screen at the same time, which is enough to produce some impressive images. The only limitation is there can only be two colours in each character square of eight-by-eight dots. A 160 × 200 mode allows four colours, including a uniform background colour, per square. The machine has no sprites, which is a shame. The 64 has these, even if it does lack the commands to use them from Basic.

Only 10K of memory is used by the graphics screen, which leaves a whole 50K of memory free for use. If graphics aren't to be used, this figure goes up to a massive 60K, better than almost all home micros. The only machines in this price range with more free memory are the QL and Advance 86a, but these are both 16-bit micros.

Sound on the Plus 4 is fairly run-of-the-mill, with two voices and simple commands to control them. All sound output is emitted through the TV loudspeaker.

Other parts of the Basic have taken a step forward, most noticeablely a powerful DO . . . LOOP command to please structured programing enthusiasts. It can go around a loop "WHILE" a condition is true, or "UNTIL" it is true.

The WHILE/UNTIL condition can either be with the word DO at the start of the loop or with LOOP at the end, which give four different ways the command can be used.

It can be used in a fifth way, with no WHILE/UNTIL condition, but instead the command EXIT within the loop. Altogether, very useful.

A number of other touches make the Basic pleasant to use. It has a good full-screen editor, AUTO, RENUMBER, and DELETE commands, and error trapping. There is also a HELP command which helps track down syntax errors in programs, and makes the part of a program line which contains the error starts flashing to highlight it.

There is also a VERIFY command to check programs have been successfully recorded on disk or tape. (A host of other commands are included for the disk drive.)

At £300, the Plus/4 will find itself competing with the Japanese MSX micros at the upper end of the home market. It has similar sized memory and a rather similar version of Basic, but lacks software compatability beyond the C16.

Commodore can claim to have succeeded in producing a good home machine in the Plus/4, but its four built-in business programs add little to it. Its price of £300, plus £45 for a cassette recorder, is too high to be competitive, so this could limit the amount of software which becomes available for it.

By Haddison Atem, a freelance journalist.

C16

IS COMMODORE'S BABY EQUIPPED TO CUT INTO THE MARKET?

The most disappointing thing about Commodore's new baby, the C16, is that it smacks of being little more than a tarted-up replacement for the Vic 20 — and not much of an upgrade at that.

The C16 should be in the shops by the time you read this, retailing at £140.

It seems aimed at a market more sophisticated than the Vic, yet less so than the 64. This ambiguity as to what the machine is actually being pitched at, prevents it from being judged on its own merits. Nonetheless, compared to its predecessors, the C16 does possess some very useful features.

One of the first things that hits you about the new Commodore 16 is the price. At £140 it's something of a snip. For that price you get the Commodore 16, and the new data cassette unit, the 1531. Also included will be a set of four cassettes, the contents of which are unknown at present.

That puts the new machine firmly in the price field of the Vic 20. The difference being that, on the Vic, the Basic was very basic.

As its name suggests, the Commodore 16 has 16K of RAM, which is a great improvement on the Vic 20's standard 5K of RAM. Likewise, the Commodore 16 has 32K of ROM, which is bigger and better than the Vic 20's 20K of ROM.

As with any machine, the ROM contains the Basic interpreter, and the graphics routines, as well as the machine operating system. In the case of the Commodore 16, the graphics facilities are very welcome. There are high resolution graphics, multi-colour graphics, a split screen offering text and high-resolution or multi-colour graphics.

As on the Commodore 64, the main display is 40-column, and the high resolution is 320 × 200 pixels.

The C16 is based around the 7401 CPU, which is a descendant of the 6502. So all machine-code users who cut their teeth on the Vic 20 or C64 will find themselves quite at home. This chip is certainly not 'leading edge' technology, but in this price bracket the buyer is more likely to be swayed by tried and reliable technology than the latest 16-bit marvel.

All Commodore owners must at some point have thrown the C64 or Vic 20 manuals out of the window in disgust, due to their impenetrability. So the manual with the C16 comes as rather a revelation. All the necessary facts are there, even if the dressing is rather sparse. It won't win any awards, but it will take you through the machine's workings.

The machine itself could pass itself off as a Vic 20 with a sun tan. The same casing has been used, as has the excellent keyboard. The only obvious difference is that the bottom function key bears the legend HELP.

We were tempted to press this immediately when we realised that the familiar arrangement whereby two cursor keys doubled to four with the shift keys had been abandoned. The new set up is to have four cursor keys, which are now in a row at the top of the keyboard, rather than beside the shift key.

A look at the back of the machine reveals one or two similarities with earlier machines, and quite a few changes. The TV and monitor connections are still the same, and there is still no Centronics or RS232 port, so you have to connect up to Commodore's own devices.

There is an expansion port, and a serial output port, but the connections are just slightly different from the old ones, so your old disk drive will not work with this micro, and neither will the C2N data recorder. You will need to use the new data recorder, the I531, which is supplied with the machine. Likewise our old 1541 disk drive will not work with the 16, and you will need to get the new SFS481 disk drive if you want disk access.

The right hand side of the casing has a socket for the power cable, as well as two sockets for joysticks. The latter have also been changed — only Commodore's 'improved advanced joysticks' will work with the Commodore 16.

All these new connecting ports, with no other significant changes to the data recorder or joysticks, did strike us as Commodore bestowing the C16 with something of a 'false sense of identity', not to mention compelling owners to go out and buy new sets of the said add-ons. Dodgy.

What is new, but very welcome, is that there is now a reset button. Wear and tear on the hardware through switching the machine on and off on any machine is minimal, but this facility on the 16 means such wear is avoided completely.

The reset button is well-recessed to avoid accidental pressing, which is just as well, since it has several uses. When the button is pressed on its own, the machine will recover from whatever is hanging it up, although the current Basic program will be lost. Pressed while the RUN/STOP key is also held down, and the machine jumps to a machine-code monitor (more of this later).

On power up, the Microsoft copyright message shows, ▶

C16 SPECIFICATIONS

CPU: 7501.
Memory: 16K (12 available to Basic).
Disks: Optional external drive.
Screen: Text-40 columns by 25 lines; hi-res graphics (320 × 200 pixels) in 121 shades.
Keyboard: 66 keys, full travel.
Interfaces: two joystick ports, cartridge slot, RF, video, sound.
Price: £140 (with cassette recorder and four pieces of software).

THE C16 HAS A NICE BASIC— BUT SHAME ABOUT THE MEMORY.

plus the news that you have 12277 bytes of memory free for use. The Basic is probably the most improved feature of the machine, making the C16 the micro the Vic 20 should have been. The Basic is Microsoft version 3.5, and is hardly what could be called state-of-the-art. But compared to the version which owners of the 64 and Vic have had to struggle with, it flows along like a dream.

The function keys have been pre-programmed so that a variety of instructions can be effected at the press of a single key. Each key has two functions making eight in all, and of the eight, half are disk housekeeping commands. The others are GRAPHIC (which enters one of the graphic modes) LIST, RUN, and the magical HELP.

The theory is that when a line of Basic is typed in which has a typing or syntax error, an error message is thrown up. If you then press the HELP key, the line in question is displayed, and the erroneous statement flashes on and off.

It's a nice idea, and it's a shame it doesn't quite work. Instead of the faulty instruction being all lit up as the manual says, the whole line is indicated, so really we're back to SYNTAX ERROR IN LINE 500.

On a more positive note, the graphics commands couldn't be easier to use, and include such commands as a comprehensive CIRCLE instruction and a PAINT command to fill in any irregular shape with a selected colour.

The highest graphics resolution is 320 × 200 pixels, but when using this mode, a massive 10K is allocated to the graphic display, leaving only about 2K for your Basic program.

Also, any character space can contain no more than two colours at any one time unless, you opt for multicolour where the resolution drops to 160 × 200 pixels, but you get four colours in the same cell. Text can be placed on the graphics screen with ease, to make the annotation of any graphics easy.

There are only two sound commands: SOUND and VOLUME, but between them quite a variety of noises can be conjured up from the two built-in sound channels. The sound instructions are simplicity itself after the PEEKing and POKEing Commodore owners are used to.

In other respects, Commodore have excelled themselves. For example, with the 16, they have written a passable Basic interpreter. So the usual FOR . . . NEXT loops are possible, as are IF- . . . THEN. And as a real concession to fans of true structured programming, there is a DO / LOOP / WHILE / UNTIL / EXIT facility. Although structural language purists might regard this as only a token introduction it adds power to the Basic.

Similarly, the GOTO instruction, has been extended – and now comes with an optional ON instruction. So 20 ON X GOTO 100, 200, 300, 400 is quite a useful way of directing program flow to any of a number of destinations depending on the value of a variable. It's also economical on memory for a machine where every byte counts.

A feature of the Basic which could make for much more friendly programs is the TRAP command which enables errors to be dealt with by a specific part of the program itself. So if the wrong type of data is given as an input, such as numerical input instead of string data or vice versa, an error message of the programmers devising will be given, instead of the rather obscure REDO FROM START which normally arises.

There is a RENUMBER instruction which allows Basic line numbers to be evened up, opened out, or closed down as the user wishes, but as yet, *Commodore Answers* has been unable to find a C16 (or a Plus 4 for that matter) which has a working AUTO line numbering command. The manual tells us that it's there, but it steadfastly refuses to work.

The TRACE feature does work through, and very handy it is too, enabling Basic programs to be de-bugged relatively easily by following the flow of the program line by line as it goes about its work.

Anyone who is either familiar with, or keen to set about learning the delights of machine code, will be pleased to find a machine code monitor built into ROM, as mentioned above. This will let you assemble a single line of code at a time, disassemble a line, find a sequence of bytes in memory or a number of other pretty useful actions.

The machine code monitor won't allow you to single step through a program at the development stage, but as it's a freebie we mustn't grumble.

So far, the specification leads us to believe that we are on to a winner, but can it be so? That has to be a matter for debate, but it might be prudent to point out one or two things that are lacking on this new marvel.

For the general ease of use of the graphic potential, we have paid the price of losing the sprites beloved of 64 users, so not all of the steps with this new machine have been forward ones. And anyone thinking of trying a Vic 20 tape on the C16 is in for a disappointment — there is no software compatability between the two stablemates.

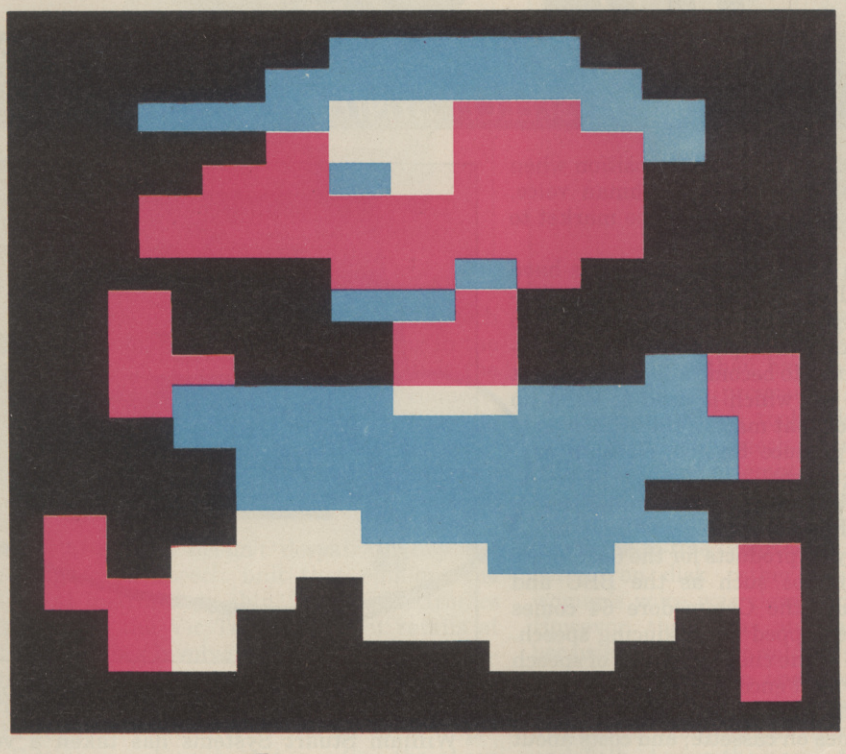
It also has to be said that the market which Commodore are aiming at with this machine might now be a little too sophisticated for a micro with only 12K of usable memory.

The C16 upholds the venerable tradition of 'babies' — late additions to an existing range that do little to improve upon their predecessors.

As mentioned earlier, it is difficult to place the machine within a current market, and in trying to create one around it, Commodore evidently believe that a market big enough to encourage independent support is out there; however, the lack of hardware / software compatibility, and the somewhat suspect nature of 'improved' joysticks and cassette loaders, for instance, do nothing to establish the credibility required to inspire support.

By Sharon Elliott, a freelance journalist.

Make new friends,



With Mirrorsoft games, you can make loads of new friends like Mr. Bounce and Ceasar the Cat. Or, now, like Dr. Frankenstein, you can create your very own monsters and aliens. As well as friends and heroes to defeat them.

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A space fantasy. Earth is threatened by attack from Alien life-forms hatching out in space. You must first overcome the Guardians. Then into the Hatchery, up and down escalators and ladders to crack the eggs before the aliens escape.

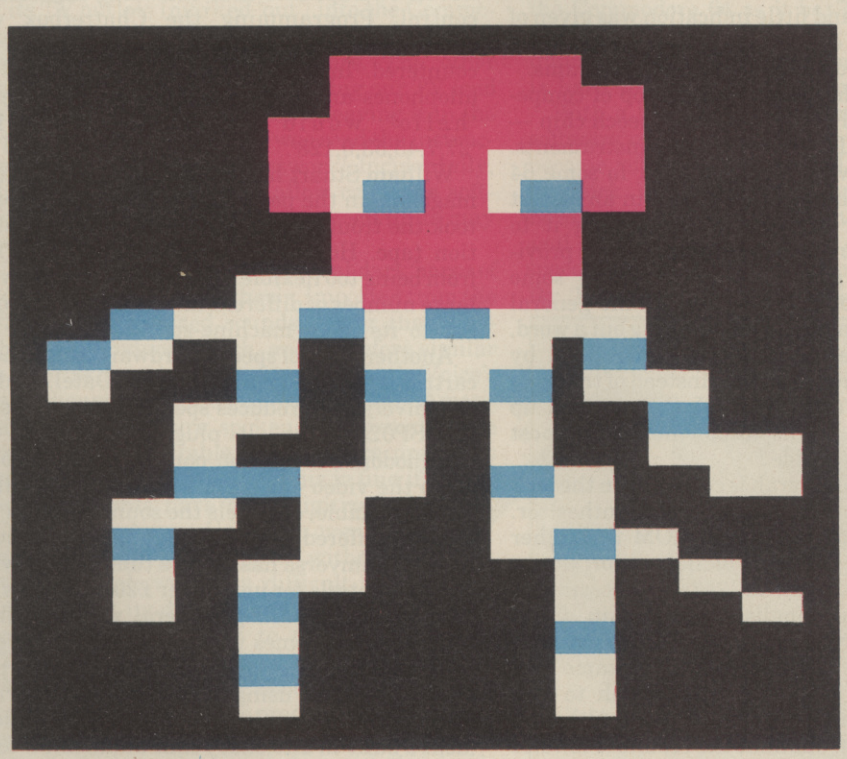
On fast loading cassette for the CBM64. **£6.95**

CATASTROPHES

Use a helicopter to build a hotel on an island paradise. But you have to move fast and design your building carefully because earthquakes, floods, storms and lightning can strike at any moment.

For one or two players. On fast loading cassette for the CBM64. **£6.95**

and enemies.



HI-BOUNCER

An arcade type game featuring Mr. Bounce and the Mr. Men. But don't get the idea that it's just a kids' game. Far from it. There are four main screens each with eight levels of difficulty and complexity. Don't worry, there's also a practice program with slower speeds.

On cassette for the BBC B. **£6.95.**

CEASAR THE CAT

Ceasar's cute and quick. Help him hunt the crowded shelves for mice who eat all the food. He must catch the mice before the food disappears. Outstanding graphics, animation and sound.

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GIFT OF THE GAB

MAKE YOUR COMMODORE 64/VIC 20 TALK BACK WITH A RANGE OF SPEECH SYNTHESIZERS

Commodores are in a strong position when it comes to imitating the human voice, with plenty of products on the market to help them.

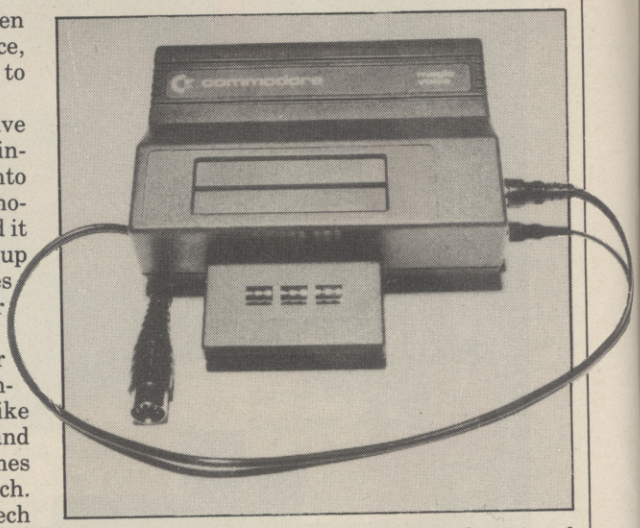
To add speech to micros, the designers have borrowed a well-known technique from linguists. Human speech can be broken down into units of sound known as phonemes, most phonemes are combined to become allophones and it is the allophone set which is used to build up English words (for that matter, the allophones can be used to produce French, German or most other languages).

There are a few speech opportunities for Vic 20 owners, but manufacturers have concentrated heavily on products for the 64. Unlike other popular micros such as the BBC and Sinclair Spectrum, the Commodore 64 comes singularly well equipped for producing speech. The result is one of the cheapest forms of speech synthesis we have yet encountered — a program called *Big Mouth* from Orbit Data.

Big Mouth comes on cassette, and costs about the same as the average computer game (£7.95). Using the program was simplicity itself, as all that was necessary was to load up and go. One of the reasons why we liked it so much was that the speech obtained was as close to human as far more expensive products. However, the instructions were slim and little indication was given of how *Big Mouth* could be integrated with third party software or even your own programs.

Moving onto hardware sees a crop of competing products all using a custom speech chip — the SPO 256 AL2 from General Instruments. The chip effectively carries a bank fo some 64 allophones which can be combined in an almost infinite number of ways. Programming it to produce something resembling speech has provided us with a good deal of fun. After some practice, you soon begin to pick up the general idea. Instead of methodically spelling out a word, better and faster results can be obtained by analysing its content — thus, instead of trying to program 'hello' using H.E.L.L.O., you look up 'hey' and 'low' in the allophone tables most manufacturers provide.

We'd guess that Currah is currently in the lead with its version of a SP0256 speech synthesizer. Piggybacked onto the speech ROM is another ROM containing a mini dictionary of words. Using a simple command, SAY, it is possible to type in straight English and obtain fairly intelligible speech from the unit. It is possible to mix straight text and phonemes in the same line, if you wish, so full marks to Currah to this friendly approach to speech synthesis. Although it would be easy to mock at the results (the voice does sound rather robotic), it can at least be understood. At just under £30, it is also affordable which will encourage software house to write compatible games and maybe educational programs.



William Stuart Systems has taken a very different route to speech synthesis with its Chatterbox II. Instead of using the expansion port like the Currah, it is connected via the serial port, which incidentally makes it Vic and Pet compatible. Sound is produced not via the TV, but its own speaker thus excluding any volume control. Programming the Chatterbox was among the most complicated methods we encountered. Instead of using the alphabet, the allophones are represented by numbers, hence 'hello' would be something like: '27,7,45,53,0,128'.

William Stuart has come under fire from this magazine in the past, so this time the company took the trouble to provide a simple demonstration tape. However, the system really suffers from being too flexible (it can be used with a very large number of different micros), and thus loses out to its more machine-specified rivals.

Another piece of speech hardware, this time in cartridge form, is produced by Datel. Called Commversa, it produces speech on the 64 using the SP0256 chip. It plugs neatly into the Commodore's expansion port with a lead going off to the video outlet. It is one of the smallest units available, channels the sound through the TV but suffered from considerable background noise. Commversa has taken a tumble pricewise, and now retails for just under £20 which makes the cheapest speech peripheral we could find.

Commversa comes with a demonstration cassette and list of allophones. They can be programmed either using POKEs or a DATA string. This hardly makes it very user friendly and it lacks a built-in dictionary that would allow some form of text input to be spoken. However, Datel did tell us that they are planning an improved version which could well include these features.

COMMODORE 64/VIC 20 SPEECH SYNTHESIZERS:

Speech synthesizer (priced £29.95) available from:
Adman Electronics,
Ripon Way,
Ripon Road,
Harrogate,
North Yorks HG1 2AU.
Tel: (0423) 62642.

Commtalk (priced £30) available from:
Andor Systems,
28 Hillside Drive,
Rathfarnham,
Dublin 14, Eire
Tel: (0001) 900107.

Magic Voice (priced £49.99) available from:
Commodore UK,
1 Hunters Road,
Weldon, Corby,
Northants NN17 1QX.
Tel: (0536) 205555.

Speech 64 (priced £29.95) available from:
Currah Computer Components,
Hollymount,
Wooler Road,
Hartlepool,
Cleveland TS26 0AH.
Tel: (0429) 34511.

Commversa (priced £19.99) available from:
Datel Electronics,
Unit 8,
Fenton Industrial Estate,
Dewsbury Road,
Fenton,
Stoke-on-Trent.
Tel: (0782) 273815.

Big Mouth (priced £7.95) available from:
Evesham Micro Centre,
Crown Courtyard,
Bridge Street,
Evesham,
Worcestershire.
Tel: (0386) 49641.

There are a number of other allophone speech units on the market, but most are losing in the rapidly growing price war. One of them is the Speakeasy, which suffered from a poor connecting lead and no in-built dictionary. Sound is channelled through its own loudspeaker rather than through the TV. Units from Adman, Admon and JCB fall roughly into this same category.

Vic 20 owners needn't despair if they are looking for a speech unit that employs the General Instruments chip. Maplin Electronics have a kit, the Vic Talk-back, that retails at £22.95. It does involve some skill with a soldering iron, but the instructions (part of Maplin Project Book 6) look reasonably comprehensive although they effectively cost an extra 70p.

Fitting speech units, not counting the above Vic Talk-back, was never much of a problem. Most simply slotted into the expansion port, or, in the case of the Chatterbox, it was the serial port. The only real struggle we had was with the Magic Voice. This has a lead that goes from one of its TV outlets (marked 'out') into the Commodore 64's video socket. Make sure you pick the right outlet on the Magic Voice. The other mistake we made was to try to plug our TV lead into the Magic Voice instead of leaving it in the micro — the moral of which was read the instructions rather than try guesswork! Incidentally, Magic Voice has a slot to allow cartridge software to be used with it, other speech units may preclude this option.

Frankly, Magic Voice is the real dark horse of Commodore speech synthesis. Imported from the US, it uses digitized sounds rather than allophones to produce speech, and therefore similar to Acorn's speech synthesizer. In Magic Voice's case, though, the words have a distinctly American flavour and are spoken by a female. The results are predictable; Magic Voice prefers to say 'hi' rather than 'hello'. This is fine if all the required words have been digitized. Saying *'Commodore Answer'* is a push over, but trying to add the 'S' to answer without an audible break was very difficult.

To give it its due, Magic Voice was both flexible and easy to program. There is a choice of using SAY "HI" or SAY154 for instance. The documentation which came with the product was commendable, and showed how to alter the rate at which words were spoken with the simple command RATE (1-10). Changing the pitch of the voice so that it would sound male, wasn't covered though. Lists are provided showing all the words both alphabetically and numerically (that is, the order in which they have been stored).

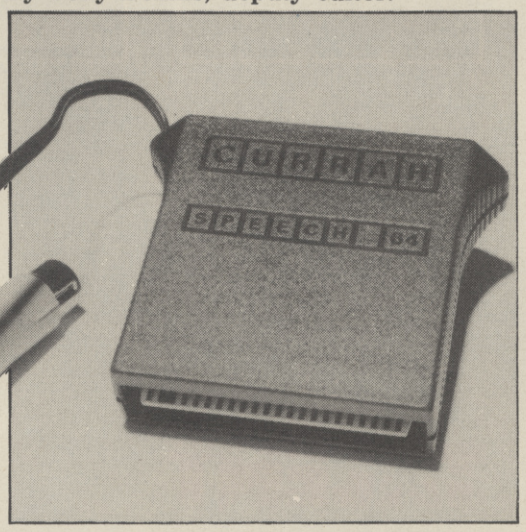
We tried two programs, both produced by Commodore, which took advantage of Magic Voice. Obviously speech wasn't a high priority with *Gorf*, since attempts at speech were often drowned by lazer zap sound effects and the like.

Fortunately *BJ Bear*, an educational program for three-to-five year-olds, was considerably better, on disk rather than cartridge. The woman's voice was clear and none too robotic. However, there was an element of cheating because the program seldom required the micro to speak more than one word at a time.

For the ultra keen there is a dedicated voice synthesizer from Namal Associates called Type and Talk. As per the name, the intention is for the user to type in exactly what is wanted and speech is produced. Type and Talk uses a different voice synthesizer chip, the Votrax SCOIA, as well as a Z80 second processor. If you key in Term 64 (see bulletin) it can be used with the Commodore 64 as it basically uses a serial interface to connect to any micro. We were impressed by the BBC version in the past, but it is hard to say if it is worth over £170.

With a little more effort from programmers, software using speech on the Commodores will become effective and useful not just a little gimmick. With prices dropping, more users will be able to afford speech peripherals and we could well reach a situation where games that aren't speech compatible are the exception.

By Tony Dennis, deputy editor.



Speakeasy (priced £34.45 available from:
Jamar,
17a Station Road,
Mirfield,
West Yorks WF14 8LN.
Tel: (0924) 495923.
Speakezy (priced £29.95) available from:
JCB Microsystems,
29 Southbourne Road,
Bournemouth BH6 5AE.
Tel: (0202) 25417.
Talk-back (priced £22.95) available from:
Maplin Electronic Supplies,
PO Box 3,
Rayleigh,
Essex SS6 8LR.
Tel: (0702) 552911.
Type & Talk (priced £171.35) available from:
Namal Associates,
153-4 East Road,
Cambridge CB1 1DD.
Tel: (0223) 355404.
SAM (priced £57.32) by
Tronix (available via Softsel dealers).
Chatterbox II (priced £44.85) available from:
William Stuart Systems,
Quarley Down House,
Cholderton,
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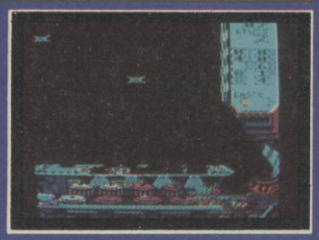
Kalah

ARCHIPELAGO



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EASING THE LOAD

A FAST-LOADING DEVICE CAN HELP SPEED-UP THE PROCESS OF ENTERING AND RETRIEVING YOUR DATA.

The necessity of having to use Commodore's own data recorder, though a financial bind, does have some advantages, because a number of companies have produced fast loading programs for use with it.

There are basically two types of fast loading programs which you may come across: the first are the loaders which you can actually buy and use to save fast copies of your own programs; alternatively, there are a number of loaders which are for software houses and duplicators use only, and which you'll find on a large number of commercial programs.

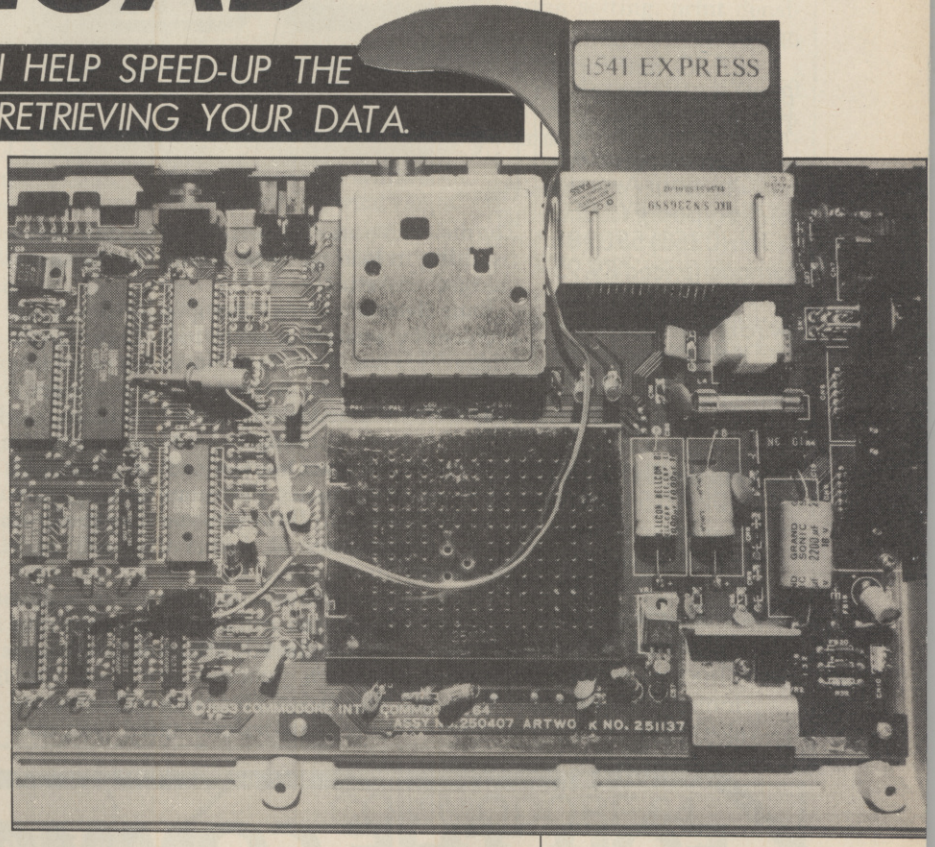
Before going any further, a quick explanation of why the cassette system is so slow, and how it is possible to increase the speed, might be in order.

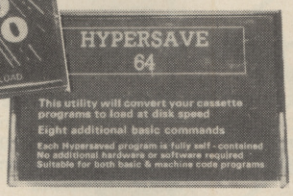
If a computer was allowed to output program bits at its own speed, you could load and save programs in a fraction of a second. Unfortunately, there is no way in which the humble cassette recorder could make any sense of the information. Consequently, all the data is sent to a cassette buffer which then transmits at a more sensible speed. The micro also performs a lot of error checking, including loading every program twice to ensure that they are the same.

One obvious method of reducing the loading time is to read each program once which would automatically double the effective speed of data transfer. This can be done by copying the kernal routines (approximately 8K) into RAM and modifying them accordingly. It is also possible to increase the baud rate from the usual 1200 baud, which has the effect of reducing reliability, but using the Commodore – compatible cassette recorder you're unlikely to have any problems.

Thus, to use a fast loader, a short machine code program is loaded at normal speed which makes the changes mentioned, autorunning to load the main program from tape.

One of the loaders which you can actually purchase for use on your own programs is called *Hypersave-64* from Dosoft. Having loaded the program into the memory, a number of additional commands are accessible allowing you to save, hypersave, and verify both Basic and RAM (machine code). Additional commands allow you to autorun machine code programs and recover Basic using '@OLD'. Once hypersaved, programs will load almost as fast as the 1541 disk drive — typically eight times faster than normal. The documentation supplied with the cassette explains all of the features, including how to hypersave commercial programs.





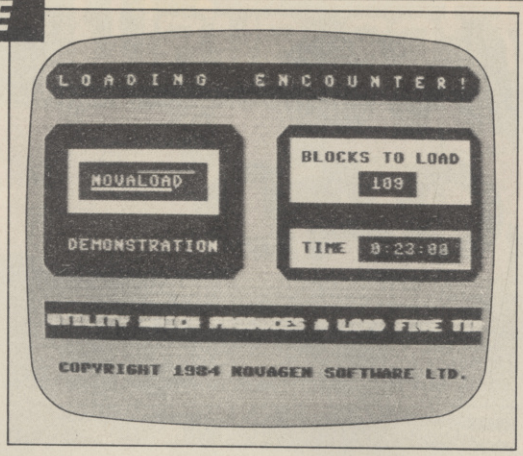
For anybody feeling a little daunted by the mechanics of hypersaving, Dosoft also produce a Rapid Backup System which does most of the work for you. Though not quite as flexible as *Hypersave 64*, it will no doubt have more appeal to most people.

The Dosoft system looks after the Commodore 64, but one product which we looked at will also work on the Vic 20 (with 8K expansion). The *Tornado* fast loader costs a little bit more than the *Hypersave 64*, but does come with a free breaker switch (at least for the moment). This is a reset switch which enables you to recover from the more serious errors without losing memory. You could build one quite cheaply, but they normally cost a lot to buy. The *Tornado* has similar loading speeds to *Hypersave 64*, which would appear to be about the maximum possible speed without a drop in loading reliability.

The documentation provided with *Tornado* (on the cassette insert) is quite sparse, but this didn't cause any problems, since the necessary commands were very simple. Both of the fast loaders we looked at were fairly simple to use, but if you want a program which really does everything for you, then choose either *Tornado* or the Rapid Backup System rather than *Hypersave 64*.

If saving time is important to you, you may also be thinking of updating to a 1541 disk drive.

(Above:) The 1541 Express cartridge loads disks at twice the speed, but does have limitations; (left:) Hypersave (from Dosoft) and Tornado (from BSF) are two software-backed fast-loaders.



The screen shot right shows Novaload's demonstration loading screen, with on-screen time, blocks to load, music and scrolling text.

Hypersave 64 (priced £7.50), and Rapid Backup System (priced £7.50) available from:
Dosoft,
2 Oakmoor Avenue,
Blackpool FY2 0EE.
Tel: (0253) 593288
Tornado (priced £9.95 with free breaker switch), available from:
BSF Computer Services,
82 Furnace Drive,
Crawley,
W. Sussex RH10 6JE.
Tel: (0293) 510020.
1541 Express cartridge at £49.95 available from:
RAM Electronics,
106 Fleet Road,
Fleet,
Hants. GU13 8PA.
Tel: (0251) 45858.

The disk drive uses the serial port on your micro, resulting in loading times similar to the turbo-charged cassettes.

Ram Electronics have attempted to reduce this problem by producing their 1541 Express cartridge. This is a little black box which plugs into the cartridge port on the back of your micro and a couple of ominous-looking wires (one black, one red). You have to connect these two to specific pins inside the machine. Connection is actually extremely easy using the comprehensive instructions provided. However, you may prefer to have a dealer insert it, rather than void your warranty.

When you switch on, the normal two line message is replaced with a three line one informing you that the 1541 Express is correctly installed.

Although disk-based programs will now load at about double their normal speed (you may have problems with some commercial programs). The 1541 Express does have its limitations.

To begin with, you can't have the Express plugged in when using cartridge software. This is all right for simple games cartridges, but unacceptable for language and utility cartridges which are used in conjunction with the disk drive. It is also only possible to have one device connected to the 64's serial port, and with two disk drives, the second can only be accessed in the normal slow mode. The documentation is sufficient for the general user, but more sophisticated programmers will find it lacking.

Nevertheless, the 1541 Express does approximately double the speed of saving/loading (not quite three or four times as fast as normal, as claimed by Ram Electronics) and, if you can afford it, is a useful addition to your system.

Glancing at the array of tapes at your local computer store, you will notice that many of them claim to be fast loading, and there are an amazing variety of quick-loader titles. One of the newest of these, called Novaload, has been used on a number of recent programs, including *Daley Thompson's Decathlon* (presently top of our Commodore Games charts).

The majority of loaders tend to show Spectrum-like flickering lines on the screen, or even turn off the screen display entirely to improve the timing. Novaload, however, allows you to display animated pictures, or even (so they claim) implement a simple bat-'n'-ball game during loading. It's a pity this product is not available for home micro owners to use with their own programs.

By Marcus Jeffery, technical writer.

FOR THE COMMODORE 64...

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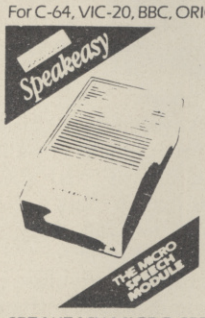

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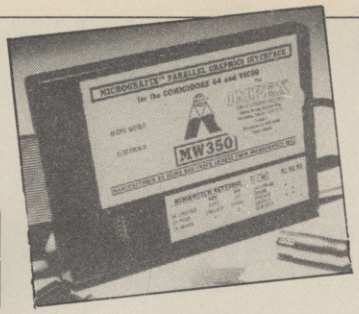
The fact that Commodore micros will only interface to Commodore printers limits the users wanting to widen the range of their hard-copy options; but now a remedy is at hand — the Impex printer interfaces.

Although Commodore printers are reasonably good, they can lack certain features (such as underlining) and are also a bind for anyone who also owns, say, a Spectrum, and would therefore have to purchase another printer. However, the Micrografix MW350 allows you to connect the Commodore 64 and Vic 20 to any printers with a standard parallel Centronics connector.

The interface itself is a black box with a few miniswitches and a test button. It has two cables, one of which plugs into the serial port on your micro (just like the Commodore printers), and the other onto the printer. Reference to the accompanying manual may then be necessary to set the switches correctly, and you're away.

The comprehensive 46-page manual has two major sections. The first of these is the Tutorial, which is designed with the absolute beginner in mind. It fully explains the rudiments of setting up the system, how to start printing, designing your own characters, and the more advanced features available. The Reference section then explains all the facilities in more detail and provides quick look-up summary tables. Throughout this manual, useful hints are given in case things go wrong.



The interface unit has the ability to emulate the Commodore 1525 printer, so the vast majority of application programs will still work correctly. With a wide range of the most popular dot-matrix printers, this will allow you to print out Commodore graphics characters.

Using the interface is extremely simple. Once it is connected it is almost transparent to the user, and can be virtually ignored.

The manual gives detailed instructions for using the interface to print program listings, disk directories, printing from inside Basic programs and even dumping text screens. Knowledge of how the interface works is only necessary in order to use the interface or printer-specific features.

UPGRADE

A number of special features are built in to the interface. One of these is the key-match facility, which automatically replaces Commodore graphic codes with more readable text. Others include margin setting, print density, upper/lower case printing, and many more.

The Micrografix MW-350 will interface to the Vic 20, Commodore 64, Commodore 16 and Plus/4 (see reviews). For anybody not requiring complete graphics capability, the slightly cheaper MW 302C will interface all standard parallel printers to any of the above machines.

At £89.95, this interface provides a cheap, versatile unit which will be of benefit to a large number of Commodore users.

By Marcus Jeffery, technical writer.

MW-350 (priced £89.95), and MW-302C (priced £66.95) are available from: **Impex Designs (UK),** Metro House, Second Way, Wembley, Middx.

SERIOUS 64 SOFTWARE

Dr. Watson Basic Course (Honeyfold)t.	10.50
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Assembler Development Pack (Commodore)d.	28.95
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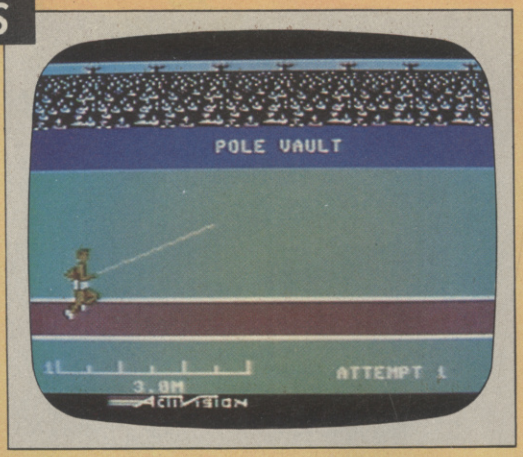
CA11

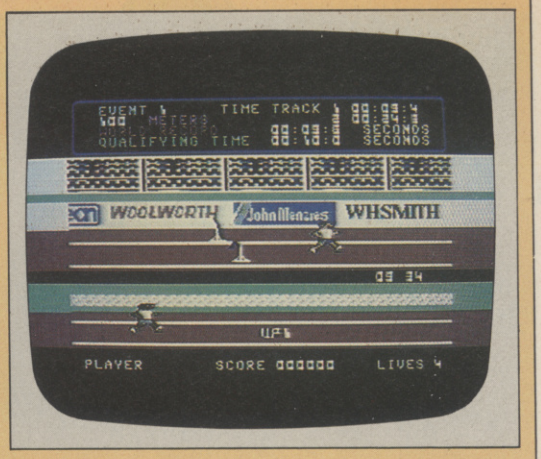
GAMES

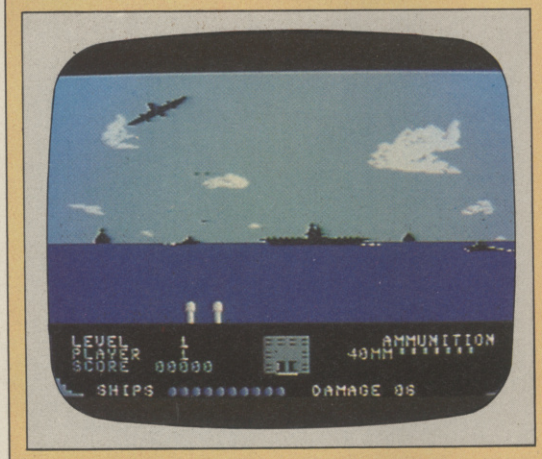
Rocketing to the top on the left are our top 20 Commodore 64 games; while on the launch pad to the right are the top 10 best-selling Vic 20 games. A review of each game appears on the following pages. The chart was compiled for Commodore Answers by RAM/C.

1	DALEY'S DECATH'N	OCEAN
2	DECATHLON	ACTIVISION
3	BEACHHEAD	US GOLD
4	ARABIAN NIGHTS	INTERCEPTOR
5	MONTY MOLE	GREMLIN
6	ASTRO CHASE	STATESOFT
7	LOCO	ALLIGATA
8	HERO	ACTIVISION
9	POTTY PIGEON	GREMLIN
10	SOLO FLIGHT	US GOLD
11	STRIP POKER	US GOLD
12	GORF	COMMODORE
13	MICRO OLYMPICS	DATABASE
14	ENCOUNTER	NOVAGEN
15	SUMMER GAMES	EPYX
16	WARLOCK	CALISTO
17	EVIL DEAD	PALACE
18	BC BILL	BEAU JOLLY
19	PITFALL	ACTIVISION
20	VALHALLA	LEGEND

1	FLIGHT 737	ANIROG
2	VEGAS JACKPOT	MASTERTRONICS
3	CHARIOT RACE	MICOR
4	PUNCHY	MR MICRO
5	HELL GATE	LLAMASOFT
6	JET PAC	ULTIMATE
7	MAX	ANIROG
8	COMPUTER WAR	THORN
9	SUB HUNT	MASTERTRONICS
10	BONGO	ANIROG







Right/far right: athletic action from Daley's Decathlon and Decathlon. Below: keeping the enemy at bay in Beach-head.

1 DALEY'S DECATHLON

Daley Thompson must have a well-developed wrist, because *Daley Thompson's Decathlon* requires more arm action than a night at The Black Horse.

As the name suggests, *Daley's Decathlon* is another track and field game, where, as Daley, you must get through the two days to become the world's greatest all-round athlete. The action begins with the 100 m. Unlike the real thing, there are two competitors: you and the computer. A lot of fanatical side-to-side joystick jerking is required to make Daley run, but we found that for all your efforts, Daley manages a quick spurt, and then decelerates into something more akin to a Sunday jog on the heath.

After this comes the long jump. Pressing the fire button increases the angle of the jump, and sends Daley floating towards the pit. The shot putt and high jump are in the same vein.

The 400m is the last event of the first day, and will have you reaching for the aerosol wrist-relaxant. If you get through this, the second day holds even more challenges in the form of the 110m hurdles, discus, pole-vault, javelin and 1500m.

Daley's Decathlon's graphics are true to the arcade original, but the amount of enjoyment we got out of the program was quite out of proportion to the feeling of exhaustion. Now exactly the most fun we've had since granny . . . wait a minute . . .

2 DECATHLON

Activision's *Decathlon* is ironically running a close second to *Daley Thomson's Decathlon* at the top of our charts.

You need a pretty solid joystick if it's going to survive the trantic waggling required to make your athlete run. In some of the events, the fire button is used to jump and throw. The graphics are very good, though a little jerky at times, and the sound is exactly as you would expect — running, with the occasional anthem and crowd cheer if you do particularly well.

Although this is called *Decathlon* and has all 10 events, there is no set sequence to their play. You may choose the events in any order, and play each one as often as you wish; not a true decathlon, but it does mean you can avoid the strenuous 1,500 metres!

This is worth buying, but before you part with your hard-earned pennies, compare it with *Daley Thompson's Decathlon*, and decide for yourself which of the two games deserves a place on your rostrum.

3 BEACH-HEAD

Even hardened games reviews get addicted sometimes, and *Beach-Head* is a case in point; the trouble is, on reflection, it is hard to see *why*.

The objective is to sneak your fleet up on the enemy's. Initially, there is a choice: either the player decides to go through a secret passage or takes the enemy head on. The secret passage involves manoeurving each ship in the fleet past hazards such as mines, torpedos and the like.

The next stage is to shoot down the attacking aircraft launched by the opposing fleet. Success at this stage allows the player to use the ship's heavy guns to blast the opposing navy out of the water. Complete this, and you get to land your tanks.

The final stage is to capture the fortress of Kuhn-Lin with your tanks. Naturally, each stage is much harder to master than the previous one.

The designer(s) of *Beach-Head* have replicated the look of warfare hardware, especially the planes and guns very well. Another blast-'em-up game — realistic, but repetitive.

4 ARABIAN NIGHTS

No, not about nocturnal goings-on in Knightsbridge, but a quirky little escapade based around the traditional stories of Eastern adventure (although being unfamiliar with these, we cannot attest to their authenticity). Several screens of *Miner*esque clambering and collecting, as you guide Imrahil the Kalendar Prince in his quest to recover his kidnapped sister.

Each stage of his travels constitutes a task-fraught screen, and the aim of each is to gather the letters A, R, A, B, I, A and N which are dotted around the scenario. For example, on the opening screen he must collect the letters from

Daley Thompson's Decathlon (priced £7.90) is available from:
Ocean Software,
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Beach-Head (priced £9.95) is available from:
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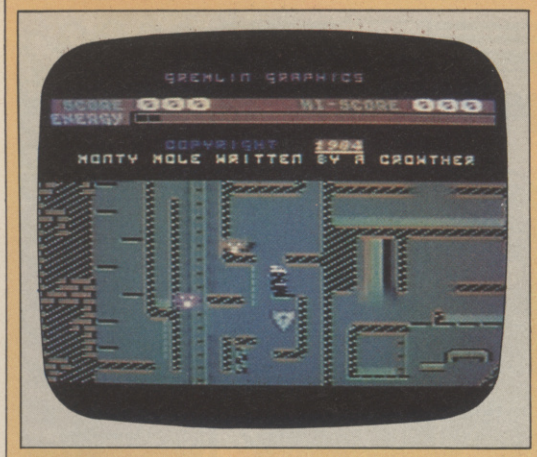

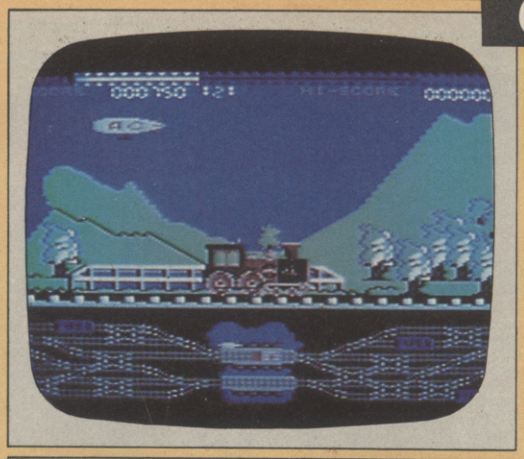

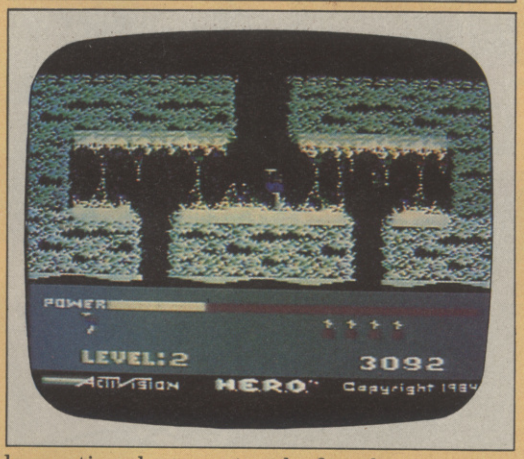

Far left: subterranean jinks with Monty Mole. Left: steaming with Loco. Below: another mission from Hero.

various quarters of a sea-going galleon, while avoiding cannon shots, Red Sea killer seagulls, and such forth. Once the magic word has been spelled out you progress to another screen.

Although we got no further than screen two, the inlay card mentions all manner of magic carpets and raft rides, bolts of lightening, and other aspects of Eastern promise. Although the tasks can get repetitive (yet another case of straight back to square one once you've lost your third life), *Arabian Nights* has an odd charm which appealled to us. An interesting feature of the game is a scene-setting speech-synthesized premable — the usual stilted phoney-nemes, but a nice touch all the same. Recommended.

5 MONTY MOLE

Monty Mole is an interesting deviation from the *Manic Miner* theme. The difference is you, the mole, have to pick up, and presumably eat, boxes of worms for energy. Then, avoiding all sorts of energy sapping beasties, you have to go mining for coal, picking up points for each nugget collected.

Unlike other games, there are no 'lives' as such, but just a certain amount of energy that is expended on each confrontation with an enemy; but similar to too many other games, the initial sequence you have to go through becomes very repetitive and boring after a while. Graphics are OK, but on the whole there is nothing special about this game.

6 ASTRO CHASE

After an impressive opening sequence of a midget being beamed up into a space ship, *Astro Chase* turns into yet another game of mindless devastation. Once again the Earth must be saved from a mass of alien hordes (whoever they may be), and get your name on Uncle Sam's plaque of heroes.

The aliens have layed Mega Mines which head from the outer reaches of the galaxy towards Earth. These must be destroyed, but other ships have been sent to protect them. Eight different forms of fighter make up the enemy, each one having a different characteristic: some ram your ship, others can go through planets, while some shoot lasers. All must be destroyed, but at the same time, energy levels have to be kept intact, else you end up doing the aliens a good turn by destroying yourself. In all, yet another run-of-the-mill space game that experienced arcade gamers should not find too difficult.

7 LOCO

This unusal game has you guiding your steam locomotive along a network of tracks. As you go, you must pick up fuel and destroy exploding handcarts, airships and planes using steam and smoke!

The only problem we found with the game is that you have to keep an eye on the track network at the bottom of the screen which means you can't watch the excellent scrolling graphics. The sound track (Alligata's pun, not ours) is also extremely good, sounding remarkably similar to a certain piece by Jean Michel Jarre.

The game itself is by no means brilliant, but it'll keep you amused for quite a while, and has got to be recommended just for the sound and graphics.

8 HERO

Hero is a mixture between a 'Jetpac' game and a kind of 'Digger'. The player is one Roderick Hero whose mission is to bury deep into the earth and rescue trapped miners. To help him in this task Roderick has at least six sticks of dynamite, as well as the more commonplace laser gun. *Hero* definitely requires a high degree of dexterity from the player in order to get deep into the game.

Reading the instructions helps, as in how to place the dynamite successfully, but watching the opening sequences is very beneficial. The graphics were OK, although the sections that included spiders were very sparse. Difficult to win but without a hall of fame to indicate the skill level it was hard to get enthusiastic about *Hero*.

9 POTTY PIGEON

Retina-boggling vector graphics and imaginative use of sound go to make *Potty Pigeon* one of the better Commodore games around at the moment. The scenario ranges from the ridiculous to the

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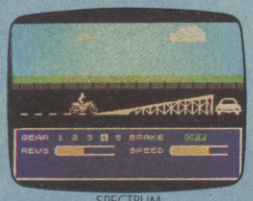

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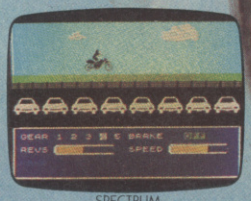

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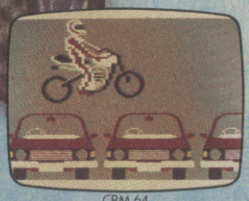

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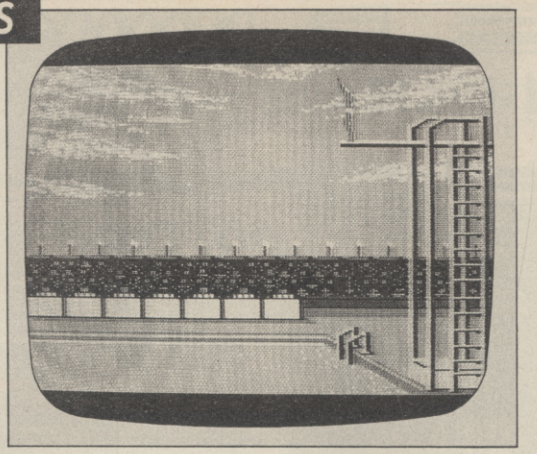

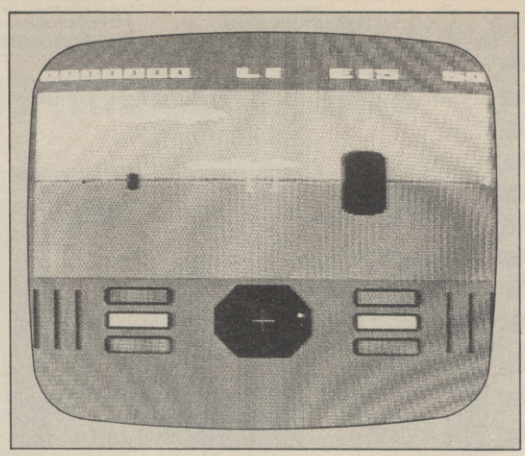

Far right: alien chasing in Encounter. Right: high diving from Summer Games.

sadistic, as you help Percy Pigeon in his endeavors to retrieve fallen branches from a busy main road, and deposit them in nests in nearby trees. However, the traffic is fast and fatal — linger too long at tyre level, and Percy suffers a messy if traditional demise, flutteringly squashed beneath the wheels, accompanied by some rather unpleasant sound effects.

Other hazards include ravenous cats and preditory ferrets, as you progress through the difficulty levels. You can also bomb the passing cars for points, with what seems to be explosive droppings.

A worthwhile game with some excellent touches, that you will not soon tire off; pigeon-haters will love it. Highly recommended.

10 SOLO FLIGHT

As its name suggests, *Solo Flight* is a flight simulator, but the picture on the screen is not the view from the cockpit — the aircraft itself appears, complete with a shadow on the ground. The small plant stays in the centre of the screen, with the simply coloured screen scrolling, slightly jerkily from left to right.

As with most simulators, the cockpit controls are shown in the bottom half of the screen, and there is a plethora of control keys for the throttle, brakes, landing gear, flaps, and so on.

The simulation is reasonable, but is prone to get a little boring, so this game is likely to appeal only to frustrated flight fanatics.

11 STRIP POKER

OK, so the idea might seem a little tacky, but it has to be said that US Gold's *Strip Poker* plays a good game; or at least Suzi and Melissa do. Both these digitized damsels are displayed in full colour, their clothes slowly dissappearing as the cards — shown at the bottom of the screen — turn in the player's favour. As Suzi has a reputation for being easy, she is the one that most players would start on.

Strip Poker is a fun game that should not be taken too seriously. Although it provides a few laughs, these soon wear off as the girls are beaten and the game made redundant. (Beware also of having to provide an explanation of why you are sitting in front of a micro, naked.)

12 GORF

Do you remember that arcade game called *Gorf*? Well, this version from Commodore is as close to the original as you're likely to find.

The game itself, which is joystick-controlled only, is a typical alien shoot-'em-up, which is played in four stages. After the initial straight space invader combat screen, there is a laser-spitting *Galaxians* variation. This is followed by a number of ships spinning out of a space-warp. Finally, you must penetrate to the power reactor of the flagship, before starting all over again with slightly nastier screens.

Nothing particularly original here, but nevertheless, this cartridge is very good value for 'blast-'em' addicts.

13 MICRO OLYMPICS

Micro Olympics is a kind of home micro version of the arcade game 'Track and Field', although it has rivals now in *Decathlon* and *Daley's Decathlon*.

These games seem designed to provide the user either with a strong right wrist or a worn-out keyboard, as erratic jiggling of joystick or punching of keys is needed to make yor athlete move. The latter is true of *Micro Olympics* since there is no joystick option. The player does get the choice of five running events, three throwing events and three jumping events. There is also a facility for loading only the part which you wish to play which saves a little time. Now the Olympics are over, it remains to be seen how long this type of game retains its popularity.

14 ENCOUNTER

A find-and-destroy extravaganza amidst superb 3D-scape that has been almost invariably praised by all who have played it. Suffice to say that you tear across the alien wastes pursuing cheeky extraterrestial saucers, monitoring the action through the inset viewscreen, guided by a dotscan radar.

When you finally catch up you blast them to smitherines — great stuff! One of those games where you find you're enjoying yourself so much that you're not noticing how many points you're ringing up. Rivetting action and realistic graphics go to make *Encounter* a must for the Commodore gamer.

15 SUMMER GAMES

Summer Games is yet another LA Olympics spin-off, but one with a great deal more imagination and better graphics than the number 1 and 2 decathlon games in our charts. The events included in the package are quite varied, including swimming, running, shooting, pole vaulting, and even gymnastics and diving.

The graphics are very good indeed, again better than the other Olympic spin-off games, but what is more interesting is the writers have had more imagination than to move the charac-

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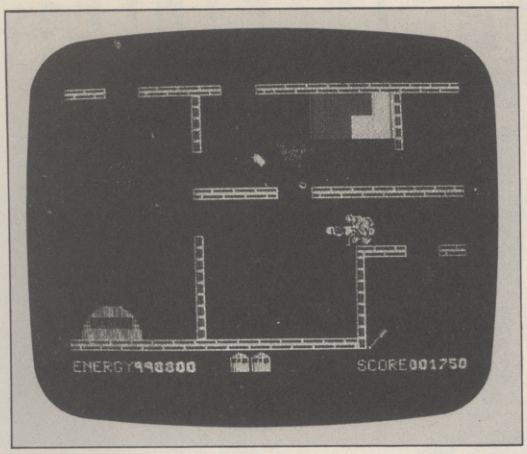

Far left: nasty goings on in Evil Dead. Left: prehistoric predicaments from BC Bill.

ters entirely by mindless movements of the joysticks. We found the gymnastics and diving events quite amusing, usually scoring a run of big fat zeros. But occasionally, by twisting the joystick through a good set of movement, pulling off a good result.

The game comes both on disk and cassette, but we would recommend the disk version. The opening sequence includes the lighting of the Olympic flame, just to get you into the right spirit but we suspect that players will tire of this sort of simulation quicker than say, a good graphic adventure, but of all the athletic simulations currently available, this is the best we have seen.

16 WARLOCK

Warlock's opening screen promises a lot, but the final result is a run-of-the-mill *Skramble* clone. Not even the title, spelt out in revolving letters, can save it from becoming 'just another game'.

The graphics on *Warlock* are good, and the sound excellent, but somehow even these, along with the job of trying to avoid rockets, force fields and what look like intergalactic beach balls, can stop you feeling a mere chill when the action reaches fever pitch. All this, however, is only a prelude to the final encounter. The purpose of your mission being to rescue several robot drones containing official secrets.

Warlock is an excellent attempt, and really worth getting just to see the title screen. But as far as the rest of the game goes, the yolk is on Calisto in this pastiche.

17 THE EVIL DEAD

Based on the nasty film of the same name, this is a rather boring game making typical use of Commodore's sprite graphics.

You start in a log cabin with four friends, who are soon turned into monsters. You spend your time rushing around the cabin, picking up weapons (picks, axes, shovels and the like), and bashing the monsters. When you clobber a monster, it breaks into parts which also chase you — suddenly you find yourself being attacked by a detached pair of legs!

The accompanying music is great, and it is almost worth buying the tape for this alone. However, if Palace Software intend to produce any more film-games, as planned, they're certainly going to have to improve their standards.

18 BC BILL

BC Bill involves a caveman who has to carry out the basic task of life in order to survive. Bill has to clobber a passing beefburger (we kid you not), tear over to the fire, roast it, and make it back to his cave before his wife (or wives) and kids starve to death. Obviously the more wives Bill acquires, (by bashing them over the head and dragging them back to the cave), the more difficult a task feeding them becomes. Nice touches abound — the seasons change, and when Bill dies two other cavemen come on and carry Bill off on a stretcher.

Originally an Imagine game, Beau Jolly look set to have a hit with this.

19 PITFALL

Although Activision's *Pitfall* paved the way for such successes as *Sabre Wulf* (on the Spectrum), it is now showing its age, and is somewhat of an 'original and worst'. You control Jungle Harry the explorer as he searches the upper and lower regions of the rather sparse jungle in search of point-gaining treasure.

Hazards include crocodiles, subterranean scorpians, and instantly-evaporating lakes that you have to take a chance on swinging across. Despite fun-sounding features, the graphics are poor, and the tasks simply not exciting enough to sustain interest, never mind excitement. Our 64 didn't even have time to get warm.

20 VALHALLA

Valhalla is a spectacular, if rather daunting, graphic adventure. It is set in the mythical land of Norse gods, goddesses, giants, dwarfs, wolves, dragons, and other fantasy creatures. The characters all have their own personality, made up from such things as goodness, badness, strength, bravery, and so on. These characters go about their lives fighting, killing, and taking advantage of each other while you sit pondering your next move.

The animation of the moving characters is reasonable, although sometimes it looks a little bit more like ice-skating than walking.

Like other adventures, the plot includes quests for treasure, but unlike most others, if you do get killed, the game does not end. Instead, you find yourself in the icy wastes of hell, along with all the other 'dead' characters, and have to find your way out.

Moving around in *Valhalla* can be a bit frustrating, since your way is constantly blocked. Sometimes this can get a little irritating, and we suspect it will take the newcomer to *Valhalla* some time before they 'tune' into the thoughts of the designers and are able to explore the game freely. Not a game for players little patience.

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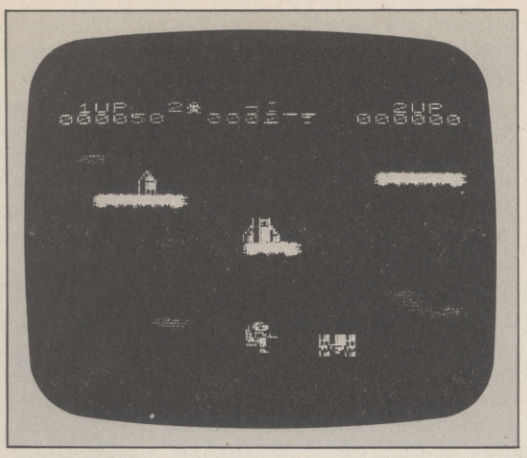
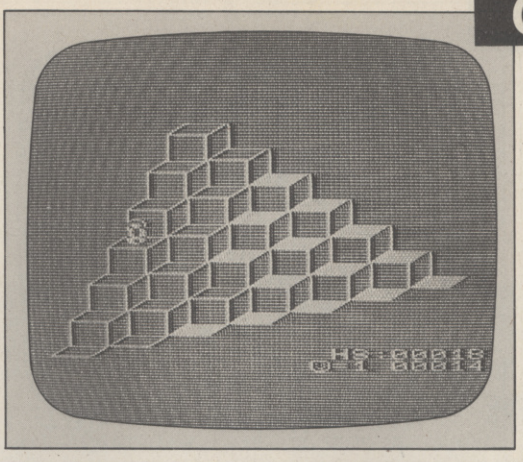




Far left: Lunacy from Jetpac. Left: Cubist fun in Anirog's Max.

VIC 20 TOP TEN

1 FLIGHT PATH

Flight Path 737 (from Anirog) is one of the many non-zapping flight simulators on the market. Not only is it impossible to blast away at other aircraft or things on the ground, but what scenario there is, is also pretty dull.

Quite simply, the object of *737* is to get the machine off the ground, fly around a bit and land. And that's it. The view out of the cockpit window takes up no more than a quarter of the screen, while all the controls on the front panel are shown digitally.

An attempt has been made to add a little excitement. This is by the inclusion of six different levels of proficiency: the first level, first solo, has the player flying their Vic to above 5,000 feet to clear mountains and land; as a test pilot, however, the aircraft must be flown to above 9,200 feet with crosswinds and engine fires.

Flight Path 737 will probably appeal to flight simulator addicts — but as far as action goes, it never gets off the ground.

2 VEGAS JACKPOT

As with most games which will run on an unexpanded Vic 20, this program is nothing to get enthused about. This is a simple fruit-machine simulation which, although well produced, has been done many times before (and was not particularly exciting the first time).

The game uses four reels with selective hold, nudge and gamble features. Starting with £10 (not real money, unfortunately), each spin costs 10p, and wins are awarded for lines of three or four, including BARs.

A reasonable fruit machine game, which may save you a little money if it keeps you away from the real thing.

3 CHARIOT RACE

This game's redeeming feature is that it runs on an unexpanded Vic; otherwise *Chariot Race* is very basic indeed. The game consists of an aerial view of two chariots, and can be played by one or two players (but the latter can become rather awkward as there is no facility for joysticks). The idea is very simple, the player attempts to dispose of opposing chariots by slamming them into the walls.

It is possible to slow down in order to ensure a good 'kill', but there are dire warnings given about fire balls if the player attempts to go too slowly. Overall, not too impressive a game.

4 PUNCHY

Punch and Judy meet *Hunchback* in this reasonable avoid-and-rescue escapade: you, as the Bobby, have to save Judy who has been encarserated in the P&J booth, braving obstacles, alligators, rotten tomatoes, custard pies, and other such perils.

With 16 screens to pass through and up to 60,000 points to gain, *Punchy* has many features that Spectrum users would take for granted, yet are sadly lacking on even expanded Vic games.

However, after trying three defective copies, we would suggest that you see the game up and running in the shop before you buy; otherwise, well recommended.

5 HELL GATE

Hellgate is a fast action 'zap-em' arcade game. The player controls not one but four laser guns, one on each side of the screen. This makes it possible to shoot your own guns and also makes the whole thing a little confusing.

With four sets of tracers screaming across the screen at the aliens, we found it very difficult to follow exactly what was going on, but nevertheless achieved quite high scores. There are some interesting and very aggressive sound effects, and Llamasoft have certainly produced a fast action game. But on the whole we feel it is just too confusing; for ardent 'zap' fanatics only.

6 JETPAC

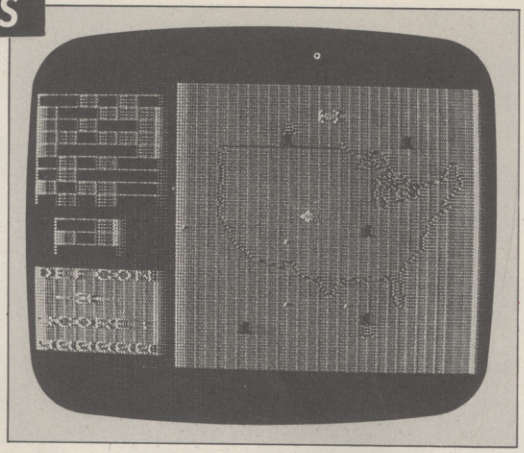
In *Jetpac* the player must control an astronaut blasting through space, the object being to pick up three parts of a space ship and fill it with fuel, while at the same time dodging some less than friendly aliens. Once refueled, the space ship can be flown to another planet.

The fun does not stop there. Although the ship has been built, more fuel must be collected, and bonus points picked up by collecting several different types of valuable goodies. Of course, the obligatory aliens are on your tail, making life very difficult. A must for shoot-em-up addicts, and those fed-up with some of the rubbish produced for the Vic 20. Recommended.

7 MAX

Basically another version of *Q-Bert*: as the ▶

Flight Path 737 (priced £7.95) is available from:
Anirog Software,
29 West Hill,
Dartford,
Kent.
Tel: (0322) 92513/8.
Vegas Jackpot (priced £1.99) is available from:
Mastertronics,
Park Lawn,
111 Park Road,
London NW8.
Tel: (01) 402 3316.
Chariot Race (priced £6.95) is available from:
Micro-Antics,
Littlehome,
Hawthorne Lane,
Codsall,
Wolverhampton.
Tel: (090) 74 51 47.
Mr Punchy (priced £6.65) is available from:
Mr Micro,
PO Box 24,
Swinton,
Manchester M27 3AI.
Tel: (061) 728 2282.
Hell Gate (priced £6.00) is available from:
Llamasoft,
49 Mount Pleasant,
Tadley,
Hants RG26 6Bn.
Tel: (07356) 4478.
Jetpac (priced £5.50) is available from:
Ultimate,
The Green,
Ashby de la Zouch,
Leicestershire LE6 5JU.
Tel: (0530) 411485.
MAX (priced £4.95) is available from:
Anirog Software
(address given, above).



Global conflict in Computer War.

story goes, Max (a little furry creature) has been abducted by the wicked witch, Zogannar, who forces Max to paint a three-dimensional pyramid, by jumping on the squares which form it. Each time Max completes a screen, the witch makes the next paint job a bit more difficult.

The game can be controlled using keys or a joystick. A useful option at the start of the game allows you to change the two colours — yes, it's only monochrome. Not a brilliant game, but for any users who still have an unexpanded Vic-20, it's as good as you're likely to find.

8 COMPUTER WAR

It took us several attempts to understand exactly what was going on in *Computer War*, despite the fact that the game claims to be based on the storyline from the film, *War Games*. The first frame has a map of the US on which attacking missiles are displayed. The player then has to decide which missiles pose the greatest threat and position the cursor over a missile.

The game then changes to a second screen where the object is to catch the missile and blow it away. Scoring a hit results in a third screen that looks like a large blank crossword puzzle. Break the code it contains to gain extra score.

We found *Computer War* both difficult and time consuming.

9 SUB HUNT

'Experience the awesome perils that lurk beneath the ocean waves', entreats the inlay card of Mastertronic's *Sub Hunt*. Considering the paucity of graphics and action, we reckon the game plumbs the depths of software design.

You control a submerged submarine as it avoids and destroys oncoming enemy torpedoes and depth charges from bombers above. Zip, zap, bang, zip, zap, bang, and so on. As mentioned, the graphics are lacking, but as much as one would expect for £1.99 on the unexpanded Vic.

10 BONGO

With a title as uninspired as *Bongo* you'd expect a pretty unsophisticated game — and you'd be right. On yet another screen of landings, ladders and slides you move a man around trying to collect diamonds, avoiding the monsters that come after you. On some of the landings there are small trampolines which allow you to jump to the next landing. The monsters don't need to use the trampolines, but they are scared of the slides. As you get better and move up a level, a second monster appears.

Sub Hunt (priced £1.99) is available from:
Mastertronics, Park Lawn,
111 Park Road,
London NW8.
Tel: (01) 402 3316.
Bongo (priced £7.95) is available from:
Anirog,
8 High street,
Horley,
Surrey.

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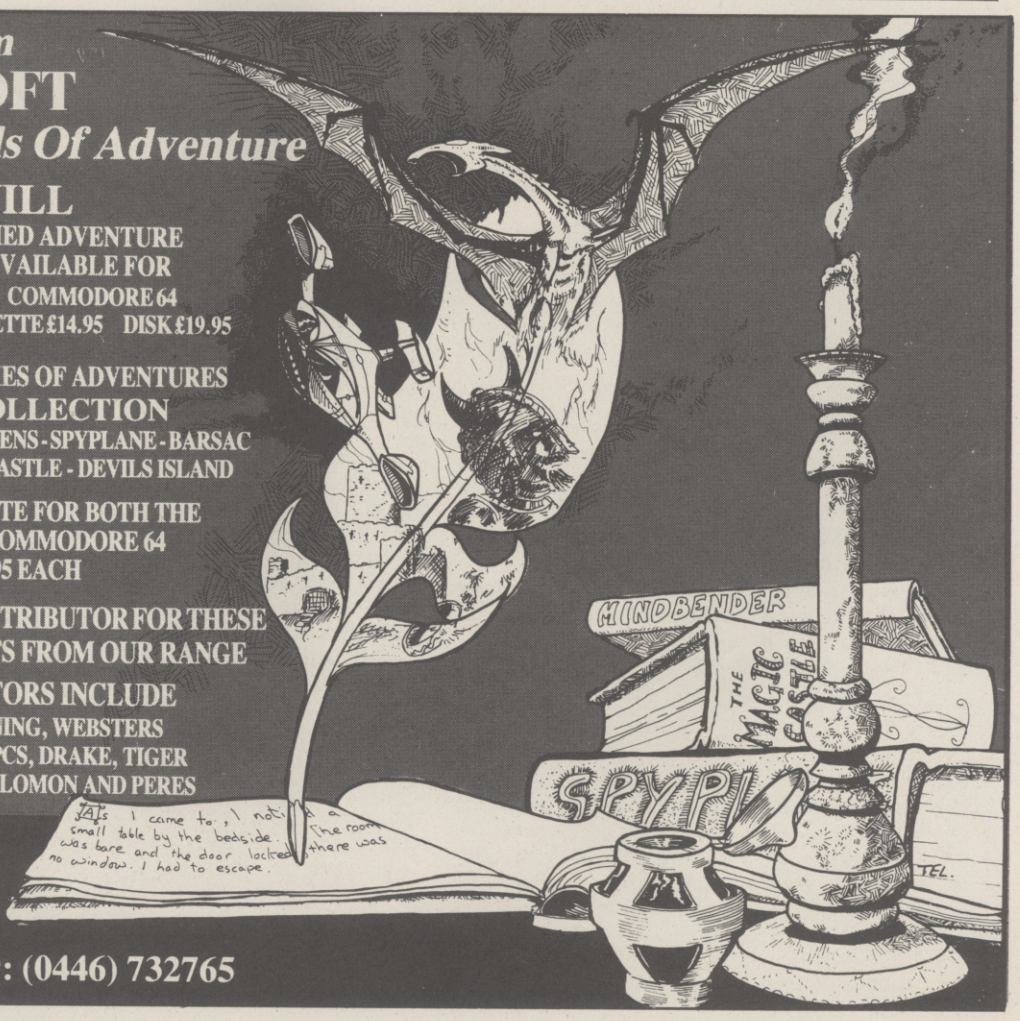


PLAY YOUR CARDS RIGHT

IN THE MOOD FOR A NICE, QUIET BRIDGE SESSION? WHY NOT SETTLE DOWN AND PLAY A HAND WITH YOUR 64?

ILLUSTRATION BY ALASTAIR TAYLOR

The card game Bridge can become an all-consuming passion for those who play it: crazed enthusiasts have been known to enforcibly abduct passers-by from the pavement in order to make up a quartet.

So players and non-players alike have been relieved at the appearance of several Bridge programs on the software market, especially for the Commodore 64 — programs that replicate the pleasure of the game, but for you and you alone, eliminating the angst by instantly providing three other players.

Equally, if you have never played the game before but want to learn, you might find the rules a little daunting we've summarized them on page 42. But what better than a patient, step-by-step teaching program to take you though the rudiments? Of the five programs reviewed here, two are purely teaching packages and three are to improve your playing.

The first program we looked at is just called *Bridge*, and comes from Handic Software, on a cartridge only. This has the advantage of fast, almost instantaneous loading, but costs more.

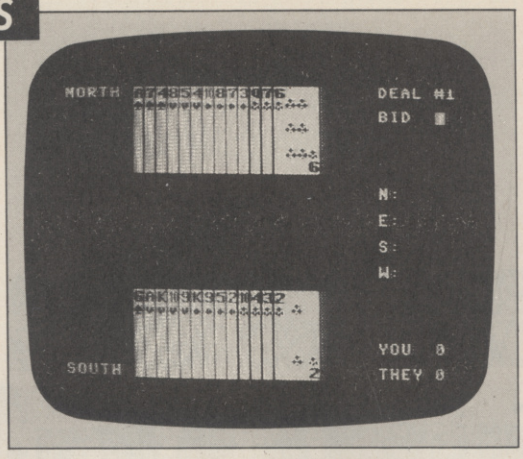
When the cartridge is plugged in and the 64 switched on, the user is asked to pick a number between 1 and 99. The computer then chooses at random from a set of 999 deals that go with that number, so it will take a long time to exhaust all the possibilities of this program and so get bored.

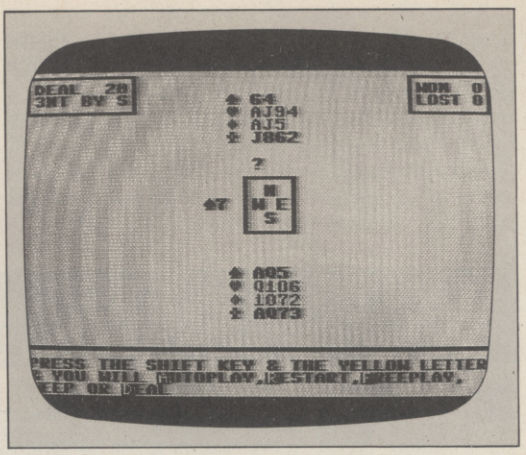
What's more, you get an indication of which of the 999 deals is on screen, so that it's possible, by making a note of the initial number (1 to 99) and then the second number (1 to 999), to get back to the same deal. When all the choosing of deals is done, the screen shows two hands, North and South. The user is South.

There is no normal bidding as such — since you can see both your own and your partner's hands, you go straight for the 'contract'. There is a coding system for suits — Spades are A, Hearts are S, Clubs X, and Diamonds are Z — and ▶

Bridge (priced £29.95) is available from:
Handic Software,
5 Albert Road,
Crowthorne,
Berkshire RG11 7LT.
Tel: (0344) 778800.
Contract Bridge (priced £9.95) is available from:
Alligata Software,
178 West Street,
Sheffield S1 4ET.
Tel: (0742) 755796.
Bridgemaster (priced £19.95) is available from:
Serin Software,
PO Box 163,
Slough SL2 3YY.
Tel: (369) 3180.

Right: views from Handic's 'Bridge 64' and Serin's 'Introduction To Expert Bridge'.





Bridge is a card game played by four people. The following is a very brief account of the rules:

1: The players sit round a small, square table, and are traditionally known as North, East, South and West. Players play in pairs: North pairs up with South, and East with West.

2: The players take it in turns to be dealer, and the dealer hands out all 52 cards, so that they all have 13 cards each. If the dealer was East, then the first player to play would be the person on East's left, that is South.

3: The game is played as a series of 'tricks'. For example, if South began with the Queen of Clubs, the other players would all play one card, preferably something in Clubs, and South would most likely win because the Queen would be the highest card in that trick.

4: Before playing, each player studies their 13 cards and guesses how many tricks they think they can 'make' or win.

5: On the basis of the guesses they make, each player says out loud how many they think they will win. This is known as 'bidding'. The fun of bidding is when South say, starts to bid, and then West follows — and then North, hearing both what his partner, South, and his opponent, West, have said, thinks very quickly and adjusts his (North's) bid.

6: Finally, when everyone has made a bid, that is called a 'contract'. Now when the game is played, points are added or lost for reaching or not reaching the contract you said.

As the article suggests, most of the fun comes from the guessing stage, but there's also the fun of playing lower cards early because you have to, and keeping the higher valued cards towards the end.

when you enter the number of tricks you think you'll take, playing starts and the other two players, East and West, appear.

As each card is played, it is removed from the hand, and shown in the centre of the screen with the other three cards. The number of tricks made or won is shown in the bottom right-hand side.

The program makes use of the Commodore 64's function keys. While playing, F1 shows all the hands, F5 shows the last trick, and F3 finishes off the deal.

This program comes with an eight-page manual, and costs £29.95. In its favour are the facility for instant loading, the many deal possibilities, and excellent graphics; on the naffish side are the higher price and the absence of detailed bidding.

Overall, if you want to try lots of different permutations and are content to only make that contract bid, then this will give you lots of enjoyment.

The second package looked at was *Contract Bridge* from Alligata Software (priced £9.95). This is mainly a bridge *playing* program, but has a short section giving you the rules at the start.

Once you are into the main section of this program you can bid in the conventional manner, as well as bid for the contract. There was one minor bug at this stage. When it came to my turn, as South, sometimes there was a figure 1 already on the screen, so I ended up making a bid I didn't want. However, the problem was easily solved when we discovered that I could cancel the 1 before entering a bid by pressing Return.

Once entered, the bidding is shown on the right-hand side of the screen, and once the bidding is complete, then play begins. The contract is listed at the top of the screen.

This package shows all four hands in play, and the actual cards are shown in the centre of the screen. Tricks won by each side are shown in the top right-hand corner, and after each contract has been played, the program shows the score card.

The third package is one of a series of three programs produced by Serin Software. Two of these programs are solely for learning how to play, while the third package is for playing and improving your play.

The first of the three (priced £19.95) is *Bridgemaster*, and the package contains not one but three cassettes, a manual, and a copy of *Begin Bridge With Rees* by Terence Rees. Only one of the tapes has the computer program on it. The other two are auditory tapes with a commentary on them for you to listen to as you proceed with the computer program.

Thus, you will need to have another cassette tape recorder as well as your Commodore data recorder to play the commentary tape through.

When you load the *Bridgemaster* program tape, the screen goes quite blank for about four minutes, and then READY appears. You then press RUN to get the first of the instructions, and by following these, the first bridge deal comes up.

At this point the first commentary, side A on tape one, can be started, and you have, coming from the second tape recorder, the instructions you need to take you through that first deal. The process of getting to a deal and then playing the accompanying commentary is repeated throughout the program. Even if you don't know very much about Bridge to start with, you soon find yourself playing along.

There are 55 deals in the program and the commentaries for these are spread over the four sides of the auditory tape.

Overall, the verdict has to be that *Bridgemaster* does take you through the game step by step, and it does have the book included. On the other hand, it is at a higher price than most games, and costs a lot more than Serin Software's *Introduction to Expert Bridge,* the next level up of instruction.

The package for this contains just one program tape, and one commentary tape, but there isn't a separate manual, since it assumed you will still be using the manual that came with *Bridgemaster*. Indeed, the tape refers you to the Bridge conventions in the manual appendix.

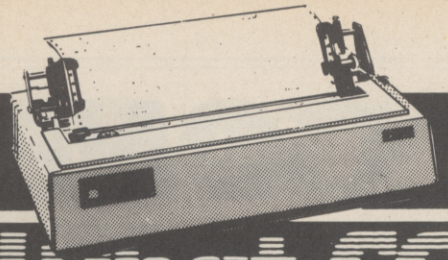
The third of the packages in the series is called *Grand Slam,* and it has the merit of providing truly random deals, using the Acol system of bidding (which is a system that recognised players generally use). There is just one cassette and a printed sheet of instructions.

After loading, the user is faced with a number of choices. You can practice with individual hands or play a complete rubber, and you can have the point score shown after the hand has been completed.

By using the shift key and single letters, five different commands are available — shift plus N gave a new deal, shift plus C claims any remaining tricks, shift plus O abandons the deal, shift plus H sees all the hands at the end of play, and shift plus S gives the score card. Unlike the Handic program, *Grand Slam* uses the keys you'd expect for suits — H for Hearts, S for Spades, and so on.

Overall, at £8.95, and from the bridge addicts point of view, *Grand Slam* plays a very enjoyable game of Bridge. Of all the packages looked at this was the one which gave the closest feeling to actually playing the game.

By Neville Ash, a Bridge player.



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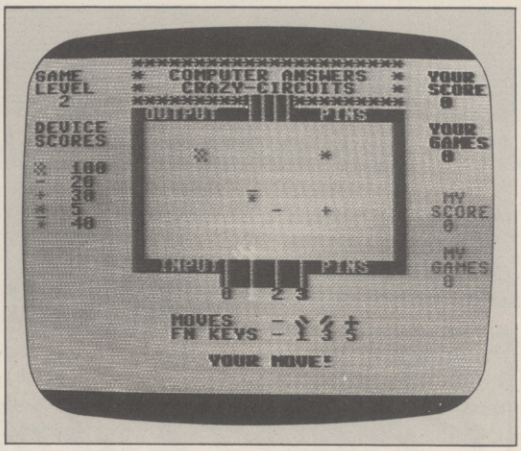
CIRCUITS GONE

Fig. 1 (below contains our 'Crazy Circuits' listing.

```
5 REM*****************************************************************************
10 REM COMPUTER ANSWERS CRAZY-CIRCUITS
15 REM AUTHOR - RICHARD DOMINEY
20 REM DATE OF CREATION & LAST UPDATE - 31/08/84 , 24/09/84.
25 REM*****************************************************************************
30 POKE 52,56:POKE56,56:REM PROTECT MY USER GRAPHICS
31 DIM C1(7),RS(5,8),WT(11,21),DV(9),CS(9),D4(3)
32 GT=0:G6=0:BG=15:P$=CHR$(144):C$=CHR$(156):R$=CHR$(31):BD$=CHR$(28)
33 C1(0)=2:C1(1)=7:C1(2)=6:C1(3)=0:C1(4)=4:C1(5)=12:C1(6)=4:C1(7)=12
34 YL$=CHR$(158):H$=CHR$(19):RV$=CHR$(18):RO$=CHR$(146)
35 OCP=1600:C6=4:GOSUB9800:REM INTRODUCTION
40 REM INITIALISE THIS CIRCUIT
45 PYC=0:S6=0:CT=CT+NX:CP=CCP+CT*2:HC=7:CC=C1(CT):GL=4-CT:LGSC=0:LF=0:PM=1:M6=1
50 CV=1:CO=CC:IFCT=(FC+NX)THENWH=INT(RND(1)*1):GOTO70
60 CH=PEEK(CP):EG=1:IFCH<>32THENMC=CH:GOSUB5000
70 IFWH=0THEN185
75 GOTO165
100 REM GET PLAYERS MOVE
105 IFDM=1THEN160
110 PRINTP$"□                    YOUR MOVE!
115 Q=1:CS=160:POKE55296+CP-1024,CC
120 Q=-1*Q:CS=CS+(128*Q):POKECP,CS:GETA$:IFA$=""THENFORI=1TO20:NEXTI:GOTO120
130 A=ASC(A$):IFA(1320RA)135THENPRINTTAB(9)"■FN KEYS ONLY PLEASE.□□":GOTO120
140 MC=A-44:PRINT"■                                                □□"
142 PRINT"□
145 GOSUB5000:REM PLAY MOVE
150 GOTO165
160 GOSUB4000:REM C64'S MOVE
165 PYC=PYC+LGSC:IFLGSC=0THEN170
166 PRINTP$H$TAB(153)"        ■■■■■■■";PYC+TG
167 PRINTH$;:FORI=1TO23:PRINT:NEXTI
170 IFLGSC=-500THENWH=0:GOTO211
175 IFLGSC=500THENWH=1:PM=PM+2↑(21-CL):GOTO210
178 IFEG=1THEN105
180 GOSUB4000:REM C64'S MOVE
185 S6=S6+LGSC:IFLGSC=0THEN190
186 PRINTH$C$"□□□□□□□□□□□□□□"TAB(33)"        ■■■■■■■";S6+T6
187 PRINTH$;:FORI=1TO23:PRINT:NEXTI
190 IFLGSC=-500THENWH=1:GOTO211
195 IFLGSC=500THENWH=0:M6=M6+2↑(21-CL):GOTO210
198 IFEG=1THEN180
200 GOTO105
205 REM END CIRCUIT SEQUENCE
210 FORI=1TO2:FORJ=10TO29:POKE55296+I*40+J,C1(CT):NEXTJ:NEXTI
211 T6=T6+S6:TG=TG+PYC
212 PRINTP$H$TAB(153)"        ■■■■■■■";TG:PRINTC$"□□□□□□□□□□□□□□"TAB(33)"        ■■■■■■■";T6
213 PRINTH$;:FORI=1TO23:PRINT:NEXTI:IFWH=0THEN240
225 PRINTP$"□    WELL DONE, YOU WON CIRCUIT";CT;"AND"
230 PRINT"    SCORED";PYC;"POINTS TO MY";S6;"!!□":GOTO246
240 PRINTC$"□    HARD LUCK, I WON CIRCUIT";CT;"AND"
245 PRINT"    SCORED";S6;"POINTS TO YOUR";PYC;".□"
246 PRINTTAB(59)"(HIT CR TO CONTINUE)";
247 GETU$:IFU$=""THEN247
250 IFCT=NCTHEN280
265 PRINT"□□□□":FORI=1TO3:PRINT"                                                  ":NEXTI
270 PRINT"                                                  □□"
273 PRINT"□    WANT TO PLAY NEXT CIRCUIT Y/N";:INPUTQ$:IFQ$="N"THEN280
275 GOTO45
280 PRINT"□□□□":FORI=1TO3:PRINT"                                                  ":NEXTI
285 PRINT"                                                  □□"
295 T6=T6*M6:TG=TG*PM
300 IFT6>TGTHENPRINTC$"□  I WON THAT GAME";T6;" POINTS TO";TG:G6=G6+1:GOTO310
305 IFTG>T6THENPRINTP$"□   YOU WON THAT GAME";TG;" POINTS TO";T6:GT=GT+1:GOTO310
306 PRINTR$"□ THAT GAME WAS A DRAW";T6;" POINTS ALL":G6=G6+0.5:GT=GT+0.5
310 PRINTH$P$"□□□□□□□□□□□□□□"TAB(33);GT:PRINTC$"□□□□□□□□□□□□□□"TAB(33);G6
313 PRINTH$;:FORI=1TO23:PRINT:NEXTI
315 PRINTR$"   WOULD YOU LIKE ANOTHER GAME";:INPUT" Y/N";Q$:IFQ$="N"THEN321
320 RESTORE:GOTO35
321 PRINT"□□□□":FORI=1TO3:PRINT"                                                  ":NEXTI
322 PRINT"                                                  □□"
325 IFG6>GTTHENPRINTC$"□   I WON THE MATCH";G6;" GAMES TO";GT;".";R$;:END
330 IFGT>G6THENPRINTP$"□   YOU WON THE MATCH";GT;" GAMES TO";G6;".";R$;:END
335 PRINTR$"□   THE MATCH WAS A DRAW";G6;"GAMES ALL";:END
4000 REM C64'S MOVE
4003 PRINTC$"□                    MY MOVE.
4005 SF=1:SP=-1:LV=0:CO=BG
4010 MC=89:LV=LV+1:SP=SP+1
4015 RS(SP,1)=CP:RS(SP,2)=HC:RS(SP,3)=MC:RS(SP,4)=LSC:RS(SP,8)=CH
4035 FORI=5TO7:RS(SP,I)=1:NEXTI
4040 GOSUB5000:REM SIMULATE MOVE
4045 IFEG=1THENRS(SP,RS(SP,3)-84)=-1*RS(SP,RS(SP,3)-84)
4050 IFLV<GLANDLF<>1THEN4010
4055 RS(SP,RS(SP,3)-84)=LSC*RS(SP,RS(SP,3)-84)
4060 MC=RS(SP,3)+1:IFMC<92ORSP=0THEN4075
4067 MN=RS(SP,5):FORI=6TO7:IFRS(SP,I)<MNTHENMN=RS(SP,I)
4068 NEXTI:IFMN<1THENAD=1-MN
4069 POKERS(SP,1),RS(SP,8):IFRS(SP,8)<>32THENPOKE55296+RS(SP,1)-1024,C6
4070 F1=(RS(SP,5)+AD)↑2+(RS(SP,6)+AD)↑2+(RS(SP,7)+AD)↑2
4071 F2=(RS(SP,5)+RS(SP,6)+RS(SP,7))+(AD*3)
4072 RS(SP-1,RS(SP-1,3)-84)=RS(SP,4)-((F1/F2)-AD)
4073 SP=SP-1:LV=LV-1:GOTO4060
4075 CP=RS(SP,1):HC=RS(SP,2):RS(SP,3)=MC:IFMC<92THEN4040
4085 MC=89:BMS=RS(SP,5):FORI=6TO7:IFRS(SP,I)>BMSTHENMC=I+84:BMS=RS(SP,I)
4090 NEXTI:SF=0:CO=CC:GOSUB5000:REM PLAY MOVE
4095 RETURN
5000 REM PLAY GIVEN MOVE
5005 LSC=0:LF=0:EG=0:LGSC=0:POKE55296+CP-1024,CO:POKECP,MC
5010 MI=MC+HC-89
5015 ONMIGOTO5035,5025,5020,5030,5020,5025,5025,5035,5030,5020,5030,5035
5020 CP=CP+40:HC=1:GOTO5039
5025 CP=CP-1:HC=4:GOTO5039
5030 CP=CP-40:HC=7:GOTO5039
5035 CP=CP+1:HC=10:GOTO5039
5039 RW=INT((CP-1024)/40):CL=(CP-1024-RW*40):CH=PEEK(CP)
5041 IFCH>88ANDCH<92THENMC=CH:GOTO5010
5045 LSC=WT(RW-4,CL-9):IFCH=32THENRETURN
5050 IFCH>127THENLF=1:LGSC=LGSC+500*SGN(LSC):RETURN
```



ELECTRONIC JINKS WITH 'CRAZY CIRCUITS'—OUR HI-TECH BRAIN GAME FOR THE COMMODORE 64.

Crazy Circuits is a game with electrifying potential; one that you can tune yourself, and even turn into an educational game.

It is set in the world of electronics, in particular the production of electronic circuit boards, indeed, the playing board is a circuit board complete with input and output pins, electronic devices, but no circuits — yet. That's your task to add the circuitry to connect input and output pins.

Moves are made alternately, each player adding a small part to the current circuit. There are only three legal moves each selected by hitting function keys 1, 3, and 5 respectively. The circuit winner is the player that causes the circuit to connect to an output pin (scoring 500 points); however, the player that runs the circuit off the board loses (scoring — 500 points).

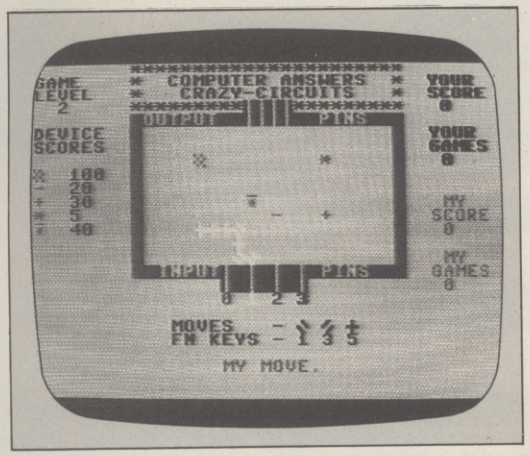
For variety, electronic devices are randomly placed at the start of each game. Devices give bonus/penalty points (plus an extra go) to the player connecting them to an input pin. Your Commodore also plays each circuit differently, three plays fast and reckless, two plays fast but negative, one plays slow and cautious, and zero plays slow and negative. The circuits you play and the number of devices used is set via the game difficulty level you choose.

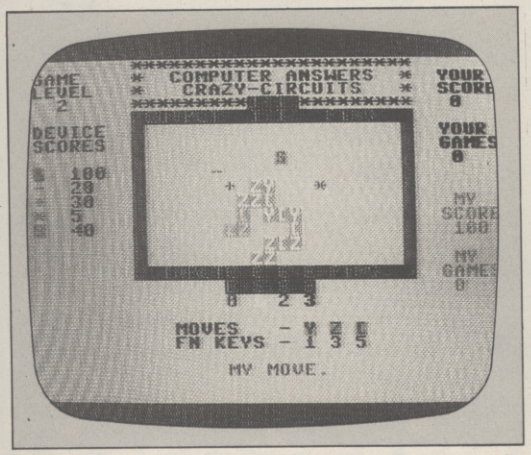
Finally, when all circuits have been played the scores are totalled and multiplied by the value of the players output pins (pin $n=2\uparrow(3-n)$); the player with the highest score wins the game.

For those of you who are interested, the following gives away a few of the programs secrets. At the top level the program is simply getting your moves, choosing it's own best move, and then playing them — it keeps doing this until a winner is found.

The program uses screen memory to represent the playing board, and employs PEEKs and POKEs to interpret and update it. Thus, to play a move the program simply POKESs the move into the

CRAZY





right position in screen memory. Well that's only half the story — how does the program know the moves position?

This is answered by using a current position variable (CP) and a variable to indicate the circuits current direction (CD). A function of these two combined with the move code will always give the new CP and CD. Now having got the move on the board and derived the new CP, the program finds there is already an old move in that position. It deals with this situation by treating this old move as a new move and repeating the play move process. This continues until a CP is found that has not been used before.

If the CP is over a device the move score is updated, and an 'extra go' flag is set; finally, if the CP is over an output pin or a board edge (reverse video areas), a 'win flag' is set to show the move has produced a winner.

That leaves the problem of the strategy used to select your computer's moves, and this program uses the trusty search — and — backtrack approach.

This makes simulated moves, which are invisible so you cannot see your computer carrying out a lot of frenzied backtracking; the procedure finally selects the move with the highest probable score, as the move to be played. Translating this algorithm to non-recursive Basic is done using a loop and a stack. The stack is used to save the volatile variables before continuing the search, as well as restoring them when backtracking.

By Richard Dominey, a computer programmer.

```
5055 EG=1:IFSF=1THENRETURN
5060 FORI=0TOVZ:IFCH=DV(I)THENZ=I
5065 NEXTI
5085 LGSC=LGSC+DS(Z)
5090 RETURN
9000 REM CREATE MY CHARACTER SET
9020 MG=14336:SG=53248
9025 POKE56334,PEEK(56334)AND254:REM TURN OFF KB INTERRUPTS
9030 POKE1,PEEK(1)AND251:REM SWITCH IN CH ROM & COPY CHAR SET
9040 FORK=0TO2047:POKEMG+K,PEEK(SG+K):NEXTK
9045 POKE1,PEEK(1)OR4:REM SWITCH OUT CH ROM
9050 POKE56334,PEEK(56334)OR1:REM TURN ON KB INTERRUPTS
9055 POKE53272,(PEEK(53272)AND240)OR14:REM SELECT MY CH SET
9060 REM NOW LOAD MY SPECIAL SYMBOLS
9070 FOR C=664TO720STEP8:FORJ=0TO7:READA:POKEMG+C+J,A:NEXTJ:NEXTC
9080 DATA 127,0,42,28,62,28,42,0
9095 DATA 127,0,8,8,62,8,8,0
9100 DATA 8,62,42,127,42,62,8,0
9105 DATA 16,8,36,18,25,36,64,0
9110 DATA 9,18,20,73,38,48,72,0
9120 DATA 3,2,14,8,56,32,64,0
9125 DATA 24,28,14,199,227,112,56,28
9130 DATA 28,56,112,227,199,14,28,24
9135 FORD3=63TO66:D4(D3-63)=PEEK(D3):NEXTD3:RETURN
9200 T6=0:TG=0:PYC=0:S6=0:PM=0:M6=0:PRINTCHR$(147)R$;
9209 PRINTTAB(9);"**********************"
9210 PRINTTAB(9);"* COMMODORE ANSWERS  *"
9215 PRINTTAB(9);"*   CRAZY-CIRCUITS   *"
9220 PRINTTAB(9);"*********"RV$BD$"||||"R$RO$"*********"BD$
9250 PRINTTAB(9)RV$" OUTPUT  ||||  PINS   "
9260 FORI=1TO10:PRINTTAB(9)RV$" ";TAB(30);" ":NEXTI
9270 PRINTTAB(9)RV$"  INPUT| | | | PINS   ":PRINTTAB(16)RV$"| | | |"
9280 PRINTTAB(16)BD$"C "YL$"1 "R$"2 "P$"3"
9285 PRINTTAB(52)P$"MOVES   - "CHR$(121)" "CHR$(122)" "CHR$(123)
9290 PRINTTAB(12)"FN KEYS - 1 3 5"H$
9300 PRINT" GAME"TAB(33)P$"YOUR":PRINTR$" LEVEL"TAB(33)P$"SCORE"
9310 PRINTR$"  "VS;TAB(33)P$;PYC:PRINTR$" DEVICE"TAB(33)P$"YOUR"
9320 PRINTR$" SCORES"TAB(33)P$"GAMES ":PRINTTAB(33)P$;GT
9330 PRINTC$H$"                    "TAB(34)"MY"
9340 PRINTTAB(33)"SCORE":PRINTTAB(33);S6
9350 PRINTTAB(74)"MY":PRINTTAB(33)"GAMES":PRINTTAB(33);GS
9390 FORD3=63TO66:POKED3,D4(D3-63):NEXTD3
9415 FORJ=2TO10:FORI=11TO0STEP-1:READX:WT(I,J)=X:WT(I,21-J)=X:NEXTI:NEXTJ
9427 DATA-200,-200,-200,-200,-200,-200,-200,-200,-200,-200,-200,-200
9430 DATA-200,40,50,60,65,70,70,65,60,50,40,-200
9435 DATA-200,50,60,70,75,80,80,75,70,60,50,-200
9440 DATA-200,60,70,80,85,90,90,85,80,70,60,-200
9445 DATA-200,65,75,85,90,95,95,90,85,75,65,-200
9450 DATA-200,70,80,90,95,100,100,95,90,80,70,-200
9455 DATA-200,75,85,95,100,105,105,100,95,85,75,-200
9460 DATA-200,80,90,100,105,110,110,105,100,90,80,-200
9465 DATA-200,85,95,105,110,115,115,110,105,95,85,-200
9470 DATA-200,90,100,110,115,120,120,125,130,140,150,1E4
9475 DATA-200,90,100,110,115,120,120,125,130,140,150,1E4
9600 DV(0)=102:DV(1)=45:DV(2)=43:DV(3)=42
9605 FORI=4TO9:DV(I)=79+I:NEXTI
9607 IFVZ=0THENRETURN
9610 FORK=0TOVZ
9615 READDS(K)
9620 RW=INT(RND(1)*5)+3
9625 CL=INT(RND(1)*11)+5
9630 PS=1024+(RW+4)*40+CL+3
9635 IFPEEK(PS)<>32THEN9620
9640 POKEPS,DV(K):POKE55296+PS-1024,C6
9645 WT(RW,CL)=WT(RW,CL)+DS(K)
9650 FORJ=-4TO4
9655 WT(RW-2,CL+J)=WT(RW-2,CL+J)+INT(DS(K)/2)
9660 WT(RW+2,CL+J)=WT(RW+2,CL+J)+INT(DS(K)/2)
9665 NEXTJ
9670 FORJ=2TO4STEP2
9675 FORI=-2TO2
9680 WT(RW+I,CL+J)=WT(RW+I,CL+J)+INT(DS(K)/J)
9685 WT(RW+I,CL-J)=WT(RW+I,CL-J)+INT(DS(K)/J)
9690 NEXTI
9695 NEXTJ
9697 NEXTK
9698 FORI=0TOVZ:POKE1025+40*(8+I),DV(I):POKE55297+40*(8+I),C1(8):NEXTI
9699 PRINTH$"                    "R$:FORI=0TOVZ:PRINTTAB(3);DS(I):NEXTI
9700 DATA100,20,30,5,40,20,30,-10,50,5
9701 PRINTH$R$:FORI=0TO21:PRINT:NEXTI
9710 RETURN
9800 PRINTCHR$(147)R$:POKE53281,15:POKE53280,2
9810 PRINTTAB(15)"WELCOME TO"
9820 PRINTTAB(11)"COMMODORE ANSWERS"
9830 PRINTTAB(14)"ZANY GAME OF"
9840 PRINTTAB(11)"******************"
9850 PRINTTAB(11)"*"RV$BD$" CRAZY-CIRCUITS "R$RO$"*"
9860 PRINTTAB(11)"******************"
9865 IF(GT+G6)<>0THEN9998
9870 PRINTTAB(41)"WOULD YOU LIKE THE INSTRUCTIONS Y/N";
9880 INPUTO$:IFO$="N"THEN9995
9890 PRINT"                    INSTRUCTIONS                    "
9891 PRINT"          REFER TO MAGAZINE ARTICLE          "
9980 PRINTTAB(59)"(HIT CR TO CONTINUE)";
9981 GETQ$:IFQ$=""THEN9981
9985 PRINTH$"                    "
9990 FORI=1TO17:PRINT:PRINT"                                                    ";:NEXTI
9995 DM=1:SW$=" ME":S2$=""
9996 PRINTH$"                    Q1- WHO AM I PLAYING  ";:INPUTNAM$
9998 IFNAM$()"C64"THENDM=0:SW$="":S2$=NAM$:GOTO10010
10000 PRINTTAB(41)"OH! PLAYING MYSELF AGAIN, HOW BORING."
10010 PRINTTAB(41)"Q2- WHAT DIFFICULTY LEVEL WOULD YOU"
10020 PRINT" LIKE";SW$;" TO PLAY AT ";S2$;" ";
10025 INPUT"1,2,3,4 OR 5   ";VS$:VS=ASC(VS$)-48
10030 IFVS<1ORVS>5THENPRINTTAB(48)"ILLEGAL LEVEL TRY AGAIN ":GOTO10020
10032 FC=5:XC=1:NX=-2:VZ=4
10035 IFVS=1THENFC=4:XC=2:NX=-1:VZ=9
10040 IFVS=2THENFC=3:XC=1
10050 IFVS=4THENFC=4:XC=0:VZ=6
10060 IFVS=5THENFC=4:XC=0:VZ=9:NX=-1
10065 PRINTTAB(48)"  PLEASE WAIT A WHILE.      "
10070 CT=FC:IF(G6+GT)=0THENGOSUB9000:REM DEFINE USER SYMBOLS
10080 GOSUB9200:REM DRAW BOARD
10090 RETURN
READY.
```

Choosing a printer is a lot easier than choosing a computer.

THERE are dozens of quality printers from which to choose. With quality price tags of around £250.

The Brother M-1009, however, breaks all the rules.

Stays defiantly below the £200 barrier.

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In the speed stakes, the M-1009 is certainly no slouch, being fully capable of up to 50 characters per second.

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A superb character recommendation.

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SHOWING FOURSIGHT

OUR ACCLAIMED FOURSIGHT GAME, NOW FOR THE C64.

After successful forays on the Spectrum and BBC machines, our *Foursight* game is now ready for the Commodore 64. *Foursight* is a game for those who like to take on their computer in a battle of wits rather than wrist wear — there are no missiles, zaps, aliens or caves, just good old brain power.

The object of the game is simple: on a board consisting of seven columns, each six units high, the winner is the first player to connect four in a line. Moves are made alternately, each player dropping one of their own counters down into any one of the columns. A winning line can be horizontal, vertical or diagonal — according to how much foresight you employ.

The starting player is chosen at random; if no player has won after 42 moves the Commodore 64 declares the match a draw.

You can select any one of four levels for the computer player opponent: level one is fast and thick as mince, level two is fast and defensive, level three is a bit slower, but plays a bit better; and level four is the slowest to make a move (about 30 seconds), but plays the best.

By Richard Dominey, a computer programmer.

Fig. 1 (below) contains a listing of the program, and our screen shots shows the game in action.

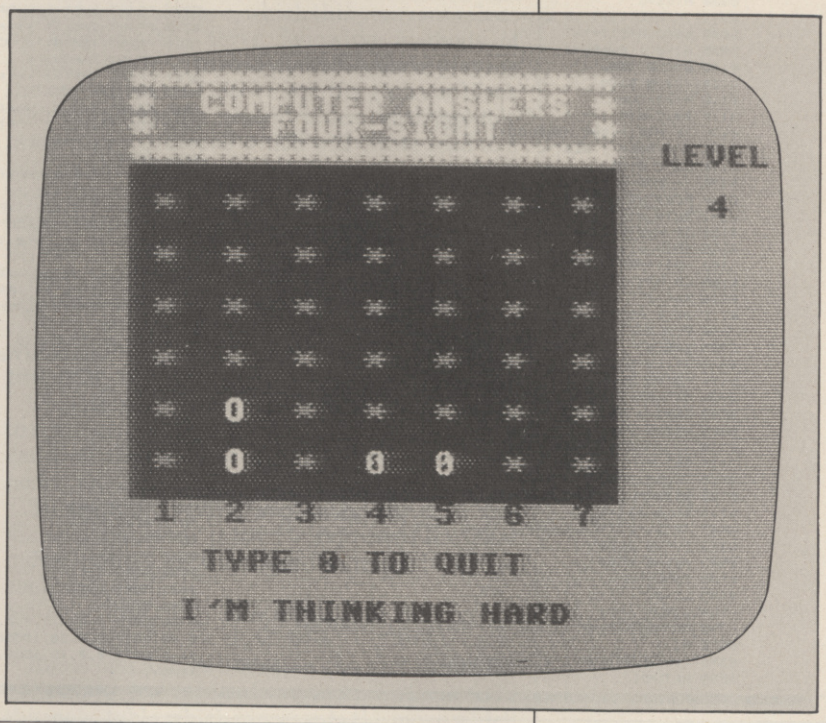

FIG. 1

```
5 REM   COMPUTER ANSWERS FOUR-SIGHT
10 REM  VERSION FOR COMMODORE 64
15 REM  DATE OF LAST UPDATE 03/05/84
20 REM  N.B. "□" IS CURSOR UP CHR$(145)
25 REM
30 GOSUB 9000
35 GOSUB 8000
40 REM PLAYER G1=0, C64 G1=1
45 G1=INT(RND(0)*2)
50 IF TM=42ORWC=1ORWH=1 THEN 65
55 IF G1=1 THEN GOSUB 6000 :GOTO 50
60 GOSUB 7000 :GOTO 50
65 PRINT"□□□";TAB(7);BL$;TAB(89);BL$
70 IF WC=1 THEN PRINT TAB(11);CHR$(158);"□□HARD LUCK, I WON." :GOTO 85
75 IF WH=1 THEN PRINT TAB(10);CHR$(5);"□□WELL DONE, YOU WON!" :GOTO 85
80 IF TM=42 THEN PRINT TAB(11);CHR$(31);"□□GOOD GAME, A DRAW."
85 PRINTTAB(42);"WOULD YOU LIKE ANOTHER GAME (Y/N)";:INPUT R$:
   IF R$<>"N" THENRUN
90 POKE 53265,PEEK(53265)AND 131
95 POKE 53280,14 :POKE 53281,6 :PRINTCHR$(154)CHR$(147);:END
1000 REM GET SCORES
1005 GAP=0 : L=1
1010 IF COL=FRST OR ROW=SND OR ZT=1 OR L=4 THEN RETURN
1015 COL=COL+A01E : ROW=ROW+ATWO
1020 IF B$(COL,ROW)="." THEN GAP=1 : UU=UU+1 : GOTO 1040
1025 IF B$(COL,ROW)<>S$ THEN ZT=1   :  GOTO 1040
1030 IF GAP=0 THEN AC=AC+1
1035 IF GAP=1 THEN DC=DC+1
1040 L=L+1
1045 GOTO 1010
2000 REM SORT SCORES
2005 DC=0:UU=0:AC=0:ZT=0
2010 COL=CL : ROW =RW : A01E=01E
2015 ATWO =TWO : FRST=C1 : SND=C2
2020 GOSUB 1000
2025 ZT=0 :COL=CL :ROW =RW :A01E=THREE
2030 ATWO =FOUR : FRST=C3 : SND=C4
2035 GOSUB 1000
2040 IF CW=1 OR LV<3 THEN 2120
2045 EVL=0
2050 IF AC<>0 THEN GOTO 2070
2055 IF DC=1 AND UU>2 THEN EVL=1
2060 IF DC>1 AND UU>1 THEN EVL=2
2065 GOTO 2110
2070 IF AC<>1 THEN GOTO 2090
2075 IF DC=0 AND UU>1 THEN EVL=1
2080 IF DC>0 AND UU>0 THEN EVL=2
2085 GOTO 2110
2090 IF AC<>2 THEN GOTO 2105
2095 IF UU>0 THEN EVL=2
2100 GOTO 2110
2105 EVL=3
2110 SCH=EVL
2115 RETURN
2120 SCH=AC
2125 RETURN
3000 REM PROC SCORES
3005 IF G1=0 THEN S$="O"
3010 IF G1=1 THEN S$="X"
3015 O1E=-1 : TWO=0 : THREE=1 : FOUR=0
3020 C1=1 : C2=0 : C3=7 : C4=0
3025 GOSUB 2000
3030 HRC=SCH
3035 O1E=-1 : TWO=-1 : THREE=1 : FOUR=1
3040 C1=1 : C2=1 : C3=7 : C4=6
3045 GOSUB 2000
3050 UPC=SCH
3055 O1E=-1 : TWO=1 : THREE=1 : FOUR=-1
3060 C1=1 : C2=6 : C3=7 : C4=1
3065 GOSUB 2000
3070 DWNC=SCH
3075 O1E=0  : TWO=-1: THREE=0 : FOUR=1
3080 C1=0 : C2=1 : C3=0 : C4=6
3085 GOSUB 2000
3090 VERTC=SCH
3095 IF CW=0 THEN RETURN
3100 MAXC=HRC
3105 IF UPC>MAXC THEN MAXC=UPC
3110 IF DWNC>MAXC THEN MAXC=DWNC
3115 IF VERTC>MAXC THEN MAXC=VERTC
3120 RETURN
4000 REM DROP
4001 FOR I=6 TO H(C)+1 STEP -1
4005 OFF=((18-(2*I))*40)+((C*3)+8)-1
4010 POKE 55296+OFF,G1*6+1
4015 POKE 1024+OFF,G1*33+15+192
4020 FOR J=1 TO 10 :NEXT J
4025 POKE 55296+OFF,14
4030 POKE 1024+OFF,234
4035 NEXT I
4040 OFF=((18-(2*H(C)))*40)+((C*3)+8)-1
4045 POKE 55296+OFF,G1*6+1
4050 POKE 1024+OFF,G1*33+15+192
4055 RETURN
5000 REM MAKE MOVE
5005 IF G1=0 THEN GOTO 5025
5010 PRINT CHR$(145)TAB(11)"I CHOOSE COLUMN ";C :FOR I=1 TO 450
     :NEXT I
5015 B$(C,H(C))="X"
5020 GOTO 5030
5025 B$(C,H(C))="O"
5030 GOSUB 4000
5035 H(C)=H(C)+1
5040 TM=TM+1
5045 G1=ABS(G1-1)
5050 RETURN
6000 REM C64'S MOVE
6005 PRINT CHR$(145)TAB(11)"I'M THINKING HARD "
```

```
6010 IF LV>1 THEN GOTO 6040
6015 C=1+INT(RND(0)*7)
6020 IF H(C)>=7 THEN GOTO 6015
6025 BEST=C
6030 GOSUB 6500
6035 GOTO 6400
6040 IF TM=0 THEN BEST=4 : GOTO 6400
6045 BEST=0 : MSTT=0 : BCS=-9999 : C=1
6050 CW=0
6055 IF WC=1 OR C=8 THEN GOTO 6400
6060 IF H(C)=7 THEN GOTO 6170
6065 CL=C : RW=H(C)
6070 GOSUB 6530
6075 MYS=SUM
6080 HISS=0
6085 IF H(C)+1=7 OR LV<4 THEN GOTO 6120
6090 B$(C,H(C))="X"
6095 G1=0 : RW=RW+1
6100 GOSUB 3000
6105 GOSUB 6520
6110 HISS=SUM
6115 B$(C,H(C))="." : G1=1 : RW=RW-1
6120 IF MYS<=1000 THEN GOTO 6135
6125 BCS=5000 : BEST=C
6130 GOTO 6165
6135 IF MYS-HISS<=BCS THEN GOTO 6150
6140 BCS=MYS-HISS : BEST=C
6145 GOTO 6165
6150 IF MYS-HISS=BCS AND MYS>MSTT THEN GOTO 6160
6155 GOTO 6165
6160 MSTT=MYS : BEST=C
6165 IF MYS>10000 THEN WC=1
6170 C=C+1
6175 GOTO 6055
6400 REM BEST MOVE
6405 C=BEST
6410 IF LV=2 THEN GOSUB 6500
6415 GOSUB 5000
6420 RETURN
6500 CW=1 : RW=H(C): CL=C : S$="X"
6505 GOSUB 3000
6510 IF MAXC>=3 THEN WC=1
6515 RETURN
6520 SUM=X(HRC+1)+X(UPC+5)+X(DWNC+5)+X(VERTC+9)
6525 RETURN
6530 CW=0 :G1=1
6535 IF LV=2 THEN SUM=0 : GOTO 6550
6540 GOSUB 3000
6545 GOSUB 6520
6550 SSUM=SUM
6555 G1=0
6560 GOSUB 3000
6565 SUM=Y(HRC+1) +Y(UPC+5)+Y(DWNC+5)+Y(VERTC+9)
6570 G1=1
6575 SUM=SSUM+SUM+Z(C)+(6-H(C))
6580 RETURN
7000 REM PLAYERS MOVE
7010 PRINT CHR$(145)TAB(9)BL$TAB(49)CHR$(145);
7015 INPUT "  COLUMN NUMBER";C
7020 IF C<0 OR C>7 THEN 7010
7025 IF C=0 THEN END
7030 IF H(C)=7 THEN 7010
7035 CW=1 : RW=H(C) : CL=C : S$="O"
7040 GOSUB 3000
7045 IF MAXC>=3 THEN WH=1
7050 GOSUB 5000
7055 RETURN
8000 REM DRAW BOARD
8001 POKE 53280,6 :POKE 53281,14
8002 POKE 53265,PEEK(53265)OR 64
8003 POKE 53284,6 :POKE 53283,6
8005 POKE 53282,14
8006 PRINT CHR$(5)CHR$(147)
8009 PRINT TAB(9)"*********************"
8010 PRINT TAB(9)"*  COMPUTER ANSWERS *"
8015 PRINT TAB(9)"*     FOUR-SIGHT    *"
8020 PRINT TAB(9)"*********************"CHR$(31)"  LEVEL"CHR$(154)
8035 FOR J=1 TO 6
8040 PRINT TAB(9)CHR$(18)BL$TAB(49);
8050 FOR I=1 TO 7 :PRINT" * ";:NEXT I
8055 PRINT CHR$(146)
8060 NEXT J
8065 PRINT TAB(9)CHR$(31)CHR$(18)BL$
8070 PRINT TAB(9)" 1  2  3  4  5  6  7"
8075 PRINT TAB(52)"TYPE 0 TO QUIT"
8080 PRINT TAB(9);:INPUT "WHICH LEVEL (0-4)";LV
8085 IF LV>4 OR LV<0 THEN 8080
8090 IF LV=0 THEN END
8095 FOR I=1 TO 16 :PRINT CHR$(145);:NEXT I :PRINT TAB(33)LV
8100 FOR I=1 TO 14 :PRINT :NEXT I
8105 PRINT TAB(9)BL$CHR$(13)
8110 RETURN
9000 REM INIT ARRAYS
9005 DIM Y(12),X(12),B$(7,6),H(7),Z(7)
9010 TM=0 :WC=0 :WH=0 :ZT=0 :BL$="                    "
9015 FOR I=1 TO 7
9016 READ Z(I)
9020 H(I)=1
9025 FOR J=1 TO 6
9030 B$(I,J)="."
9035 NEXT J
9040 NEXT I
9065 FOR K=1 TO 12
9070 READ X(K)
9075 NEXT K
9080 FOR K=1 TO 12
9085 READ Y(K)
9090 NEXT K
9095 RETURN
9100 DATA 1,2,3,4,3,2,1
9105 DATA 0,6,30,10000,0,6,28,10000,0,6,26,10000
9110 DATA 0,2,15,1000,0,2,14,1000,0,2,13,1000
READY.
```


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BULLDOG BREED

GET YOUR TEETH INTO 'BULLDOG'—A GAME OF SUBTLETY, BUT WITH A HINT OF AGGRO.

Bulldog is a game with a pedigree similar to previous *Answers* successes *Foursight* and *Reversi*. The game has many variations, including charging across a field trying to avoid a line of opponents set on blocking the way, in the manner of the old playground favourite.

The object of the game is to get your line from one side of the board to the other, thus preventing your Commodore completing it's line. The board consists of your set of 20 nodes organised in five rows by four columns, together with your computer's set but organised in four rows by five columns. For indentification purposes, each of your nodes is labelled with blue letters and those for your 64 are labelled with green letters in the range A-T.

Moves are made alternately, each player adding a line to the board in an attempt to build a winning line. When prompted you may add a horizontal or vertical line anywhere on the board by indentifying it's endpoint nodes. You must specify two endpoints that are adjacent, have not yet been linked, and are not separated by one of your computers lines.

You may get your computer to play at one of four difficulty levels. Levels one and two play reasonably fast and reckless, while levels three and four play slow and cautious. This game, like noughts and crosses, gives the starting player a distinct advantage, especially when played on a small board. Therefore, you will start when playing levels one and three, otherwise your computer will start; this helps even up the odds for a match.

Just to add a little spice to matches, your Commodore scores each game by awarding two points * difficulty level for a winning line.

Now down to the nitty-gritty of how *Bulldog* was developed. The problem is how to get the computer's best move, which this program solves by adopting the three following methods of attack: first, to scan every possible move playing the one which will either win the game or block your winning move; second, to scan each possible move playing the one which will either lead to a win on the next go, or block your move which would lead to a win on the next go (this is not implemented for levels one and two); and thirdly, to use a greedy algorithm associated with a weight table representing the current plane of desired moves (low weight implies a good move).

Then a mathematical function is applied which adds a weight, representing a moves potential, to the weight already derived.

This program uses a three dimensional array to represent the board, each array element value defining the state of a line between any two nodes belonging to a given player.

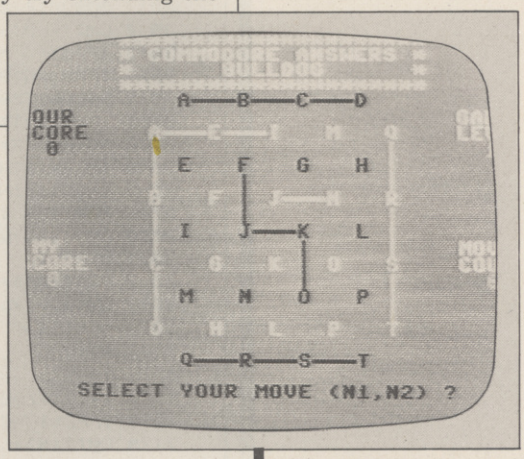
To identify, verify, and score moves a two dimensional array is used to represent the legal moves table with the following items listed for each move:—

NODE	NODE	BLOCKING	MOVE
X	Y	MOVE PTR	SCORE

Items one and two contain the end points for each move; item three is a pointer to the row in the move table which represents the move which would block this one. A pause to study the board shows a players and opponents moves are mutually exclusive, so we do not need a table for each player.

That's enough delving into the bowels of the program; now its for you to play the game. Good luck, and if it gets too easy try extending the board size!

By Richard Dominey, a computer programmer.



The screen shot above shows Bulldog in action; the listing for the game begins left.

FIG. 1

```
10 REM
20 REM BULLDOG
30 REM AUTHOR RICHARD DOMINEY
40 REM DATE OF LAST UPDATE 23/09/84
50 REM WRITTEN FOR COMPUTER ANSWERS
60 REM
61 DIM PG(1,13,13),LM(24,3),STK(1,1),LN(13,4):W6=0:W7=0
62 P$=CHR$(31):C$=CHR$(153):R$=CHR$(5):RV$=CHR$(18):RO$=CHR$
   (146):H$=CHR$(19)
63 GOSUB10499:REM INTRODUCTION
65 GOSUB 9000:REM INITIALISATION
70 GOSUB10000:REM DRAW BOARD
71 IFVS=2ORVS=4THEN75
72 IFDM=0THEN195
73 PP=1
75 HM=INT(RND(0)*2)+5+INT(RND(0)*2)*4:TK=HM:GOTO184
76 PRINTCHR$(153-PP*122);"□                    MY TURN.
77 IFGC>5THENSP=SV:EW=EV
78 FORVR=SPTOEW
79 SK=VR:BSC=2000:NM=-1:IF((VR=2ORVR=3)AND(VS<3ORGC<8))THEN160
80 PL=SK+PP-INT((SK+PP)/2)*2
89 IFINT(RND(0)*2)=1THEN100
90 IFVR=2THENPRINT"□ MM..THAT NEEDS A LITTLE MORE THOUGHT."
95 IFVR=3THENPRINT"□  DON'T WORRY I'M STILL THINKING HARD. "
```

FIG. 1

```
100 YS=0:NM=NM+1:IFNM=25THEN160
101 IF LM(NM,3)>400 THEN 100
102 Z=NM:IFPL=1THENZ=LM(NM,2)
104 N1=LM(Z,0):N2=LM(Z,1)
110 ONSK/2+1GOSUB3800,6000,2500
120 IFYS=1THENTK=NM:GOTO184
150 GOTO 100
160 NEXTVR
184 HM=TK:IFPP=1THENHM=LM(TK,2)
185 A=LM(HM,0):B=LM(HM,1):VA=A:VB=B
186 IFA=0THENVA=B-4
187 IFB=13THENVB=A+4
188 A$=CHR$(68+VA):B$=CHR$(68+VB)
190 PL=PP:GOSUB3000:IFEN=1GOTO2000
193 IFDM=1THENPP=PP*(-1)+1:GOTO76
195 GOSUB 5000 :REM GET PLAYERS MOVE
200 IFEN<>1THEN76
2000 REM END GAME
2005 PRINT"□                                                    "
2010 IFPL=0THENPRINTC$"□  HARD LUCK, I WON. SCORING";VS*2;"POINTS.":W6=W6+VS*2
2020 IFPL=1THENPRINTP$"□  WELL DONE, YOU WON! SCORING";VS*2;"POINTS.":W7=W7+VS*2
2021 PRINTH$"[redacted]   "P$;W7
2022 PRINT"[redacted]   "C$;W6;"[redacted]":IFPL=1THENPRINTP$;
2023 PRINT"  WOULD YOU LIKE ";
2024 INPUT"ANOTHER GAME Y/N";Q$:IFQ$<>"N"THENRESTORE:GOTO63
2025 PRINT"□□                                                   "
2026 PRINT"                                                     "
2027 IFW6>W7THENPRINTC$"□□      I WON THE MATCH";W6;"POINTS TO";W7;".□":END
2030 IFW6<W7THENPRINTP$"□□    YOU WON THE MATCH";W7;"POINTS TO";W6;".□":END
2035 PRINT"□□□THE MATCH ENDED IN A DRAW";W6;"POINTS EACH□.":END
2500 REM SCORE MOVE
2501 SC=LM(NM,3):IFVS=1THEN2507
2502 N3=LM(LM(NM,2),0):N4=LM(LM(NM,2),1)
2503 IFPG(0,N1,N1)=1ORPG(0,N2,N2)=1THENP8=0:N8=N1:N9=N2:GOSUB2700
2504 IFPG(1,N3,N3)=1ORPG(1,N4,N4)=1THENP8=1:N8=N3:N9=N4:GOSUB2700
2507 IFSC<BSCTHENTK=NM:BSC=SC
2508 RETURN
2700 MIN=-1:MAX=14
2705 MIN=MIN+1:IFMIN=N8THEN2715
2710 IF(PG(P8,N8,MIN)=0ANDPG(P8,N9,MIN)=0)THEN2705
2715 MAX=MAX-1:IFMAX=N9THEN2725
2720 IF(PG(P8,N8,MAX)=0ANDPG(P8,N9,MAX)=0)THEN2715
2725 DI=INT((MAX-1)/4)-INT((MIN-1)/4)
2730 SC=SC-DI↑3:RETURN
3000 REM PLAY MOVE
3005 GC=GC+1:PRINT"□□□□□□□□□";TAB(33);GC;"[redacted]"
3011 GOSUB10200
3012 LM(TK,3)=10000
3013 IFPG(PL,A,A)=0THENN9=A:GOSUB3176
3014 IFPG(PL,B,B)=0THENN9=B:GOSUB3176
3015 GOSUB3500:IFEN=1THENRETURN
3020 SG=1:Z=TK:IFPL=1THENSG=-2
3030 AD=4:OFS=0:N5=1
3040 IFZ>=16THENAD=3:OFS=16:N5=0:SG=-1*SG-1
3050 S=OFS+(INT((Z-OFS)/AD)*AD)
3060 FOR I=S TO S+AD-1
3070 LM(I,3)=LM(I,3)+(40/SG)*N5+SG
3071 NEXT I
3072 FORI=OFS+Z-STOOFS+(AD*(AD-1))+Z-SSTEPAD
3073 LM(I,3)=LM(I,3)-(20*SG)*N5-1-SG
3074 NEXT I
3076 RETURN
3176 I=-1
3177 I=I+1:Z=LN(N9,I):IFZ=-1THENRETURN
3178 IFPL=1THENZ=LM(Z,2)
3179 LM(Z,3)=LM(Z,3)-B6:GOTO3177
3180 RETURN
3500 REM ADD MOVE TO PATH GRAPH
3510 PG(PL,A,A)=1
3520 PG(PL,B,B)=1
3530 FOR I=0 TO 13
3540 IF PG(PL,A,I)=1 THEN PAR=B:GOSUB 3700
3550 IF PG(PL,B,I)=1 THEN PAR=A:GOSUB 3700
3560 NEXT I
3590 IF PG(PL,0,13)=1 THENEN=1
3630 RETURN
3700 REM LINK PATHS IF REQUIRED
3710 IF PAR=I THEN RETURN
3720 FOR J=0 TO 13
```

FIG. 1 CONT.

```
3730 IF PG(PL,I,J)=1 OR PG(PL,PAR,J)=0 THEN 3750
3740 PG(PL,I,J)=1
3750 NEXT J
3760 RETURN
3800 REM WOULD MOVE WIN IF PLAYED
3810 SA=PG(PL,N1,N1):SB=PG(PL,N2,N2)
3815 IF SA=0 AND SB=0 THEN RETURN
3820 PG(PL,N1,N1)=1:PG(PL,N2,N2)=1
3830 IF(PG(PL,N1,0)=1ANDPG(PL,N2,13)=1)THENYS=1:GOTO3840
3835 IF(PG(PL,N1,13)=1ANDPG(PL,N2,0)=1)THENYS=1
3840 PG(PL,N1,N1)=SA:PG(PL,N2,N2)=SB
3845 RETURN
5000 REM GET MOVE
5005 PL=1
5010 PRINTP$"□       SELECT YOUR MOVE (N1,N2)        ";:INPUT"■■■■■■■";A$,B$
5020 IFA$=B$THEN5100
5025 V$=A$:GOSUB10100:A=V:V$=B$:GOSUB10100:B=V
5027 IF(A=-1ORB=-1)THEN5100
5030 SW=B
5032 REMIF(A=B)AND(A=0ORA=13)AND((ASC(B$)-ASC(A$))↑2=1)THENGOSUB10200:GOTO5107
5040 IFA>BTHENB=A:A=SW
5045 IF(A$="D"ANDB$="E")OR(A$="P"ANDB$="Q")THEN5100
5046 IF(A$="E"ANDB$="D")OR(A$="Q"ANDB$="P")THEN5100
5050 TK=-1:ED=-1:S=1
5060 ED=ED+1
5061 IFED=25THEN5100
5070 IF LM(ED,0)=A AND LM(ED,1)=B THEN  TK=LM(ED,2)
5080 IF TK=-1THEN 5060
5090 IF LM(TK,3)<400 THEN5105
5100 PRINTP$"■         ILLEGAL MOVE TRY AGAIN   ↑□□":GOTO5010
5105 PRINT"□                                        "
5106 PRINT"■                                        □□"
5107 GOSUB3000
5110 RETURN
6000 REMLOOK FOR PINCER
6005 IFPG(PL,N1,N1)=0ANDPG(PL,N2,N2)=0ANDN1<>0ANDN2<>13THENRETURN
6015 CN=N1:SN=0:AN=N2:OSN=13:GOSUB6050:IFYS=1THENRETURN
6020 CN=N2:SN=13:AN=N1:OSN=0:GOSUB6050:IFYS=1THENRETURN
6025 CN=N1:SN=13:AN=N2:OSN=0:GOSUB6050:IFYS=1THENRETURN
6030 CN=N2:SN=0:AN=N1:OSN=13:GOSUB6050
6035 RETURN
6050 IFPG(PL,CN,SN)<>1ANDCN<>SNTHENRETURN
6053 PC=0
6055 FORK=0TO13
6060 IFPG(PL,AN,K)<>1ANDK<>ANTHENGOTO6090
6065 L9=-1
6066 L9=L9+1:L=LN(K,L9):IFL=-1THEN6090
6068 Z=L:IFPL=1THENZ=LM(L,2)
6069 IFLM(Z,3)>400THEN6066
6070 IF(LM(L,0)=KAND(PG(PL,LM(L,1),OSN)=1ORLM(L,1)=OSN))THENPC=PC+1
6075 IF(LM(L,1)=KAND(PG(PL,LM(L,0),OSN)=1ORLM(L,0)=OSN))THENPC=PC+1
6080 IFPC>=2THENYS=1:RETURN
6085 GOTO6066
6090 NEXTK
6095 RETURN
9000 REM INITIALISATION
9011 GC=0:EN=0:SV=0:EV=4:SP=4:EW=EV:B6=5:PP=0
9012 FORI=0TO1:FORJ=0TO13:FORK=0TO13:PG(I,J,K)=0:NEXTK:NEXTJ:NEXTI
9020 FOR I=0 TO 24
9030 FOR J=0 TO 3
9040 READ LM(I,J)
9050 NEXT J
9060 NEXT I
9061 FOR I=0 TO 13
9062 J=-1
9063 J=J+1:READ LN(I,J)
9064 IF LN(I,J)<>-1 THEN 9063
9065 NEXT I
9070 DATA 0,1,0,100,0,2,4,100,0,3,8,100,0,4,12,100
9071 DATA 1,5,1,100,2,6,5,95,3,7,9,95,4,8,13,100,5,9,2,100,6,10,6,95
9075 DATA 7,11,10,95,8,12,14,100,9,13,3,100
9076 DATA 10,13,7,100,11,13,11,100,12,13,15,100,1,2,16,110,5,6,19,109
9080 DATA 9,10,22,110,2,3,17,110,6,7,20,109,10,11,23,110,3,4,18,110
9081 DATA 7,8,21,109,11,12,24,110
9095 DATA 0,1,2,3,-1,0,4,16,-1,1,5,16,19,-1,2,6,19,22,-1,3,7,22,-1
9096 DATA 4,8,17,-1,5,9,17,20,-1,6,10,20,23,-1,7,11,23,-1,8,12,18,-1
9097 DATA 9,13,18,21,-1,10,14,21,24,-1,11,15,24,-1,12,13,14,15,-1
9099 RETURN
10000 PRINTCHR$(5)CHR$(147);
10001 POKE53280,6:POKE53281,14
```

FIG.1 CONT.

```
10005 PRINTTAB(9)"*********************"
10010 PRINTTAB(9)"* COMMODORE ANSWERS *"
10015 PRINTTAB(9)"*       BULLDOG      *"
10020 PRINTTAB(9)"*********************"CHR$(31)
10025 FORI=1TO17STEP4
10027 PRINTTAB(13);
10030 FORJ=ITOI+3
10035 PRINTCHR$(J+64);SPC(3);
10040 NEXTJ:PRINTTAB(161):NEXTI
10045 PRINTCHR$(19);TAB(201);CHR$(153)
10050 FORI=1TO4:PRINTTAB(11);
10055 FORJ=ITOI+16STEP4
10060 PRINTCHR$(J+64);SPC(3);
10065 NEXTJ:PRINTTAB(161):NEXTI:PRINT"□"
10070 PRINTCHR$(5)
10071 PRINTH$"[illegible]"
10072 PRINTP$"  YOUR";TAB(32);R$"GAME"
10073 PRINTP$"  SCORE"R$;TAB(32);"LEVEL"
10074 PRINTP$"   ";W7;TAB(33);R$;VS;"[illegible]"
10075 PRINTC$"   MY"R$;TAB(32);"MOVE"
10076 PRINTC$"  SCORE"R$;TAB(32);"COUNT"
10077 PRINTC$"   ";W6;TAB(33);R$;GC;"[illegible]"
10079 PL=1:FORJ=0TO2:A$=CHR$(65+J):B$=CHR$(66+J):GOSUB10200
10080 A$=CHR$(81+J):B$=CHR$(82+J):GOSUB10200:NEXTJ
10081 PL=0:FORJ=0TO2:A$=CHR$(65+J):B$=CHR$(66+J):GOSUB10200
10082 A$=CHR$(81+J):B$=CHR$(82+J):GOSUB10200:NEXTJ
10083 RETURN
10100 REM CONVERT
10105 V=ASC(V$)-68
10110 IFV<-3ANDV>16THENV=-1:RETURN
10115 IFV<1THENV=0
10120 IFV>12THENV=13
10125 RETURN
10200 REM DRAW MOVE
10205 BR=6-(PL*2):BC=10+(PL*2)
10210 T1V=ASC(A$):T2V=ASC(B$)
10215 TAV=T1V:TBV=T2V
10220 IFTAV>TBVTHENSW=TBV:TBV=TAV:TAV=SW
10225 R1=INT((TAV-65)/4):C1=TAV-(R1*4)-65
10230 CH=66:HV=40:TV=TBV-TAV
10235 IF (PL=1ANDTV=1)OR(PL=0ANDTV=4)THENCH=67:HV=1
10237 IF PL=0THENSW=R1:R1=C1:C1=SW
10240 PN=((BR+(R1*4))*40)+(BC+1+(C1*4))
10245 FOR I=1 TO 3
10250 POKE1024+PN+(HV*I),CH:POKE55296+PN+(HV*I),13-(PL*7)
10255 NEXTI:RETURN
10499 T$=CHR$(154):HL$=CHR$(158):POKE53280,14:POKE53281,6:PRINTCHR$(147)T$
10500 PRINTTAB(14);"WELCOME TO"
10510 PRINTTAB(11);"COMMODORE ANSWERS"
10520 PRINTTAB(14);"LATEST GAME"
10530 PRINTTAB(54)"***********"TAB(54)"*"RV$HL$" BULLDOG "RO$T$"*"
10531 PRINTTAB(14)"***********"
10532 IF(W6+W7)>0THEN10620
10533 PRINTTAB(43)"WOULD YOU LIKE INSTRUCTIONS Y/N ";:INPUTQ$:IFQ$="N"THEN10590
10540 PRINT"□                INSTRUCTIONS              "
10541 PRINT"    TO WIN THE GAME YOU MUST GET YOUR  "
10542 PRINT" BLUE LINE TO LINK THE TOP OF THE BOARD"
10543 PRINT" WITH THE BOTTOM, BEFORE I GET MY GREEN"
10544 PRINT" LINE LINKING THE LEFT OF THE BOARD "
10545 PRINT" WITH THE RIGHT. WE TAKE TURNS TO ADD A"
10546 PRINT" LINE SECTION (NODE A - NODE B) TO THE"
10547 PRINT" BOARD UNTIL ONE OF US WINS. GOOD LUCK,"
10548 PRINT" AND MAY THE BEST PLAYER WIN.          "
10549 PRINTTAB(54)"YOURS C64."
10550 PRINTTAB(41)"P.S. I WILL PLAY MYSELF IF YOU ANSWER"
10560 PRINT" C64 TO QUESTION 1."
10570 PRINTTAB(59)"(HIT CR TO CONTINUE)";
10580 GETUE$:IFUE$=""THEN10580
10590 PRINTH$"[illegible]"
10600 FORI=1TO17:PRINT:PRINT"                                                  ";:NEXTI
10605 DM=1:SW$=" ME":S2$=""
10610 PRINTH$"[illegible] Q1- WHO AM I PLAYING ";:INPUTNAM$
10620 IFNAM$<>"C64"THENDM=0:SW$="":S2$=NAM$
10630 PRINTTAB(41)"Q2- WHAT LEVEL OF DIFFICULTY WOULD YOU"
10640 PRINTTAB(1)"LIKE";SW$;" TO PLAY AT ";S2$;" 1,2,3, OR 4 ";
10650 INPUT"     [illegible]";VS$:VS=ASC(VS$)-48
10660 IFVS<1ORVS>4THENPRINTTAB(48)"ILLEGAL LEVEL TRY AGAIN †[illegible]":GOTO10640
10670 PRINTTAB(48)" PLEASE WAIT A WHILE.       "
10680 RETURN
READY.
```

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SOUNDS SIMPLE

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The need to work out all those awkward PEEKs and POKEs has put many users off exploring the Commodore 64's exceptional sound capabilities. However, there are shortcuts to getting your chords and clunks, and this article outlines a few of them.

Fig's 1 contains some routines for use in your own programs; a simple synthesizer program to help you choose the parameters for the routines, along with some examples.

Lines 1000 onwards of *Fig 1* give you four Basic routines that will enable you to make interesting sounds on your computer: *Setvoice1, Setpulse, Setfilter,* and *Setvoice3*. To call up each routine, simply set the parameters required and then GOSUB to 1000, 2000, 3000, or 4000 as appropriate. You will also need line 50 in your main program.

For simple notes, you only need routine *Setvoice1*, with values set for:

○ A, D, S, R — that is Attack, Decay, Sustain, Release (0-15).

○ L, Z — which determine the duration of the note and the pause following its release.

○ N, O — the Note number and Octave, which determine the frequency of the note. O is from 0 to 7, whilst N can take values from 0 to 12 (except that when O=7, N=12 is not allowed). N=0 gives note C, N=2 gives D, and so on.

○ W determines the type of wave form: 1= triangular, 2= sawtooth, 4= pulse, and 8= noise. Other numbers give combinations, but don't go above 8 (if you do, noise will lock-out. If this happens, recover by typing POKE 54276,8:POKE 54276,0). Finally, the variable, B, M and K control selection of three special features, discussed below. For simple notes, set these to zero.

If you are using the pulse waveform (W=4 if alone or W=5,6,7 if in combination) then before calling up *Setvoice1* you should first set

FIG.1

```
10 REM EXAMPLE
20 REM ***
30 REM
40 REM SET P TO START OF SOUND CHIP
50 P=54272
60 REM
70 A=0:D=10:S=0:R=0:V=15:M=1:K=0:B=0
80 C=0:X=0:Z=0:W=1
90 READ L,Y,T,O,N
100 IF L=0 GOTO 140
110 GOSUB 4000
120 GOSUB 1000
130 GOTO 90
140 END
500 DATA  400,4,5,6,8
510 DATA  400,4,1,6,4
520 DATA  400,4,3,6,6
530 DATA  800,3,8,5,11
540 DATA  400,3,8,5,11
550 DATA  400,4,3,6,6
560 DATA  400,4,5,6,8
570 DATA 1000,4,1,6,4
580 DATA  400,4,5,6,8
590 DATA  400,4,1,6,4
600 DATA  400,4,3,6,6
610 DATA  800,3,8,5,11
620 DATA  400,3,8,5,11
630 DATA  400,4,3,6,6
640 DATA  400,4,5,6,8
650 DATA 1000,4,1,6,4
660 DATA 1200,4,1,6,4
670 DATA 1200,4,1,6,4
680 DATA 1200,4,1,6,4
690 DATA 1200,4,1,6,4
700 DATA 1200,4,1,6,4
710 DATA 1200,4,1,6,4
720 DATA 0,0,0,0,0
1000 REM ****
1010 REM SETVOICE1
1020 REM ****
1030 REM
1040 POKE P+24,V+16*B+128
1050 POKE P+5,A*16+D
1060 POKE P+6,S*16+R
1070 F=2^(4+O+N/12)
1080 G=F/0.06097
1090 POKE P,G-256*INT(G/256)
1100 POKE P+1,INT(G/256)
1110 POKE P+4,W*16+1+2*K+4*M
1120 FOR I=1 TO L:NEXT
1130 POKE P+4,W*16+2*K+4*M
1140 FOR I=1 TO Z:NEXT
1150 RETURN
2000 REM ***
2010 REM SETPULSE
2020 REM ***
2030 REM
2040 U=X*40.95
2050 POKE P+2,U AND 255
2060 POKE P+3,U/256
2070 RETURN
3000 REM ***
3010 REM SETFILTER
3020 REM ***
3030 REM
3040 G=C*20.47
3050 POKE P+22,G/8
3060 POKE P+21,G AND 7
3070 H=0
3080 IF B>0 THEN H=1
3090 POKE P+23,H
3100 RETURN
4000 REM ***
4010 REM SETVOICE3
4020 REM ***
4030 REM
4040 F=2^(4+Y+T/12)
4050 G=F/0.06097
4060 POKE P+15,INT(G/256)
4070 POKE P+14,G-256*INT(G/256)
4080 RETURN
READY.
```

the pulse width by calling *Setpulse*. For this, you need to set – X, which is a value from 0 to 100 giving the percentage of each pulse cycle which is 'up' rather than 'down'. X=50 gives a square wave.

The other two routines enable you to use three of the 64's special sound features, namely filtering, ring modulation, and synchronisation. If you want to filter your sounds, first call *Setfilter*, which needs the parameter C, which is a figure from 0 to 100 determining the cut-off frequency for the filter.

Then call *Setvoice1*, having set B to 1 for a low-pass filter, 2 for band-pass, or 4 for high-pass (or 3, 5, 6, or 7 for a combination). For ring modulation, or to get bells ringing in your ears, or synchronisation, or to get interesting note combinations, first call *Setvoice3*. Parameters required are Y, the octave number for voice 3 and T, the note number for voice 3.

Then call *Setvoice1*, having set M=1 (ring modulation), or K=1 (synchronisation). This will do things to the sound from voice 1 on the basis of the frequency of voice 3.

To help you experiment with different values for the parameters, we've provided a simple synthesiser program called *Workshop Fig. 2*. SAVE the routines to tape or disk before adding the rest of the lines in *Fig. 1* to complete the *Worshop* program. The type RUN, and you will get all the parameter values shown on the screen. To change parameters, press the appropriate code letter, such as A for Attack, followed by the new value and then RETURN.

For M and K, simply pressing the key will change the value from 0 to 1 or 1 to 0. Remember that values (N) for voice 1 are given by pressing the correct number on the top row of the keyboard and note that left arrow is 0, 0 is 10, + is 11, and – is 2. The top row of keys then becomes a musical keyboard, with notes from C to C! in semitone steps.

Try the parameter values in *Fig. 3* for examples of various sound effects. Notice how useful filtering is with the noise waveform (example 1). Hear the difference when you change the value of C. With ring modulation (examples 2, 3, 4), note the different sounds you get by changing the relationship between the voice 3 frequencies. In the case of example 3, pressing other keys on the top row will send shivers down your spine. Finally, blow a hooter and ring a friend with our two synchronisation examples (5, 6).

To round off the show, SAVE the *Workshop* program (complete with routines), then load back in the routines saved earlier. Now add the values given in *Fig. 3* and set the program running. Have fun!

By Mike Phipps, a computer programmer.

Fig. 1 (opposite page) and Fig. 2 (below) contain sound routines for use in your own programs; Fig. 3 contains parameter values for examples of various effects.

FIG.3 EXAMPLE

	1	2	3	4	5	6
A	0	0	12	12	2	0
D	8	10	4	4 15	4	8
S	0	0	0	0	15	15
R	0	0	0	7	0	8
O	5	6	5	0	6	5
N	5	4	1	1	0	10
W	8	1	1	0	1	1
X	0	0	0	5000	0	0
L	200	1000	2000	0	1000	500
Z	0	0	0	0	0	0
B	4	0	0	0	0	0
C	50	0	0	1	0	0
M	0	1	1	0	0	0
K	0	0	0	6	1	1
T	0	6	6	0	6	6
Y	0	4	3		4	0

FIG.2

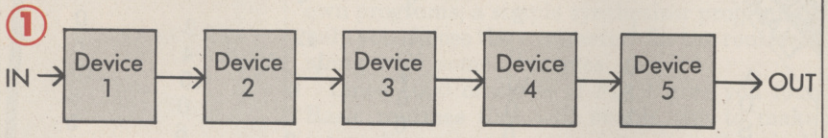
```
10 REM SOUND WORKSHOP
20 REM ***
30 REM
40 REM SET P TO START OF SOUND CHIP
50 P=54272
60 REM
70 DIM J(255)
80 J$="←1234567890+-"
90 FORI=1TOLEN(J$)
100 J(ASC(MID$(J$,I)))=I-1
110 NEXT
120 A=8:D=8:S=8:R=8:V=15:M=0:K=0:B=0
130 C=50:L=200:Z=0:O=3:Y=3:T=6:W=1:X=50
140 PRINT"□":PRINT" SOUND WORKSHOP":PRINT:PRINT:PRINT:PRINT
150 PRINT"ATT(A)=";A,"DEC(D)=";D,"SUS(S)=";S,"REL(R)=";R:PRINT
160 PRINT"VOL(V) ";V,"OCT(O)=";O,"PWID(X)";X,"WAVE(W)";W:PRINT
170 PRINT"DURATION OF NOTE(L)";L:PRINT
180 PRINT"DURATION OF WAIT(Z)";Z:PRINT
190 PRINT"FILT(B)";B,"CUTF(C)";C:PRINT
200 PRINT"RMOD(M)";M,"SYNC(K)";K:PRINT
210 PRINT"VOICE-3:":PRINT"NOTE(T)";T,"OCT(Y) ";Y:PRINT
220 GET A$:IFA$="" GOTO 220
230 IF A$="A" THEN PRINT"ATT=";:INPUT A
240 IF A$="D" THEN PRINT"DEC=";:INPUT D
250 IF A$="S" THEN PRINT"SUS=";:INPUT S
260 IF A$="R" THEN PRINT"REL=";:INPUT R
270 IF A$="W" THEN PRINT"WAVE";:INPUT W
280 IF A$="V" THEN PRINT"VOL=";:INPUT V
290 IF A$="X" THEN PRINT"PWID";:INPUT X
300 IF A$="B" THEN PRINT"FILT";:INPUT B
310 IF A$="C" THEN PRINT"CUTF";:INPUT C
320 IF A$="L" THEN PRINT"DURN";:INPUT L
330 IF A$="Z" THEN PRINT"WAIT";:INPUT Z
340 IF A$="O" THEN PRINT"OCT=";:INPUT O
350 IF A$="T" THEN PRINT"NOTE";:INPUT T
360 IF A$="Y" THEN PRINT"OCT=";:INPUT Y
370 IF A$="M" THEN M=1-M
380 IF A$="K" THEN K=1-K
390 IF ASC(A$)=43 OR ASC(A$)=45 GOTO460
400 IF ASC(A$)=95 GOTO 460
410 IF ASC(A$)>47 AND ASC(A$)<58GOTO460
420 GOSUB 2000
430 GOSUB 3000
440 GOSUB 4000
450 GOTO 140
460 N=J(ASC(A$))
470 GOSUB 1000
480 GOTO 220
490 END
```

COMPETITION

When the space shuttle is about to take off, one of the computers always seems to get stroppy — four computers and a backup, and they hardly ever seem to be able to agree on anything.

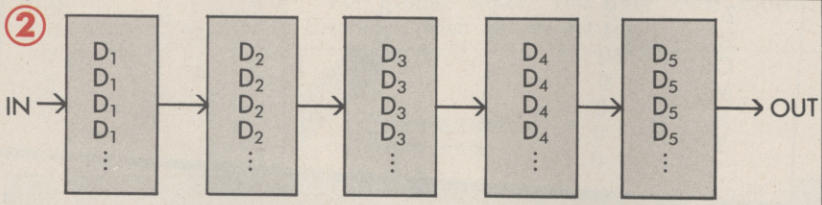
Well, NASA is a pretty big organisation with plenty of experts to sort these problems out, and this kind of mishap is the inspiration for our new competition. First prize is a gleaming new Panasonic dot-matrix printer, along with a Micrografix interface. There are also 10 runners-up prizes of boxes of Elephant disks and T-shirts. Here's what you have to do: read the following scenario carefully, and solve the three problems based around it.

1



MESS (Middleton East Space Shuttle) has decided to opt for a modular design for their on-board computer. There are five devices (modules) in the system, each of which performs a different operation. These devices are then linked in series (see above), so that all the operations are performed.

2



Unfortunately, all the devices are being purchased from Claude Simpler Computers, and they are not too reliable. *Fig. 3* (above, right) shows the price of each device and its reliability. The reliability of a device is the probability that the device will function properly. Although the reliability of each device is not too bad, that of the entire system is very poor. This is easily calculated, by multiplying the reliabilites of each device in the system: Reliability = 0.70 * 0.85 * 0.45 * 0.80 * 0.75 = 0.16065.

3

Device:	Price:	Reliability:
1	£25	0.70
2	£50	0.85
3	£12	0.45
4	£70	0.80
5	£35	0.75

One way to improve this is to use duplicate devices which are connected in parallel through the use of switchboard circuits (*Fig. 2*). If N copies of a device with reliability R are connected together in parallel, then the reliability of this stage becomes: Reliability = $1-(1-R)^N$.

For example, if two copies of device 1 were connected in parallel, the reliability of this stage in the system would be: Reliability = $1-(1-0.90)^2 = 0.99$. The reliability of the entire system is then calculated by multiplying the reliability at each stage together.

So now the scene has been set, here are your problems. . .

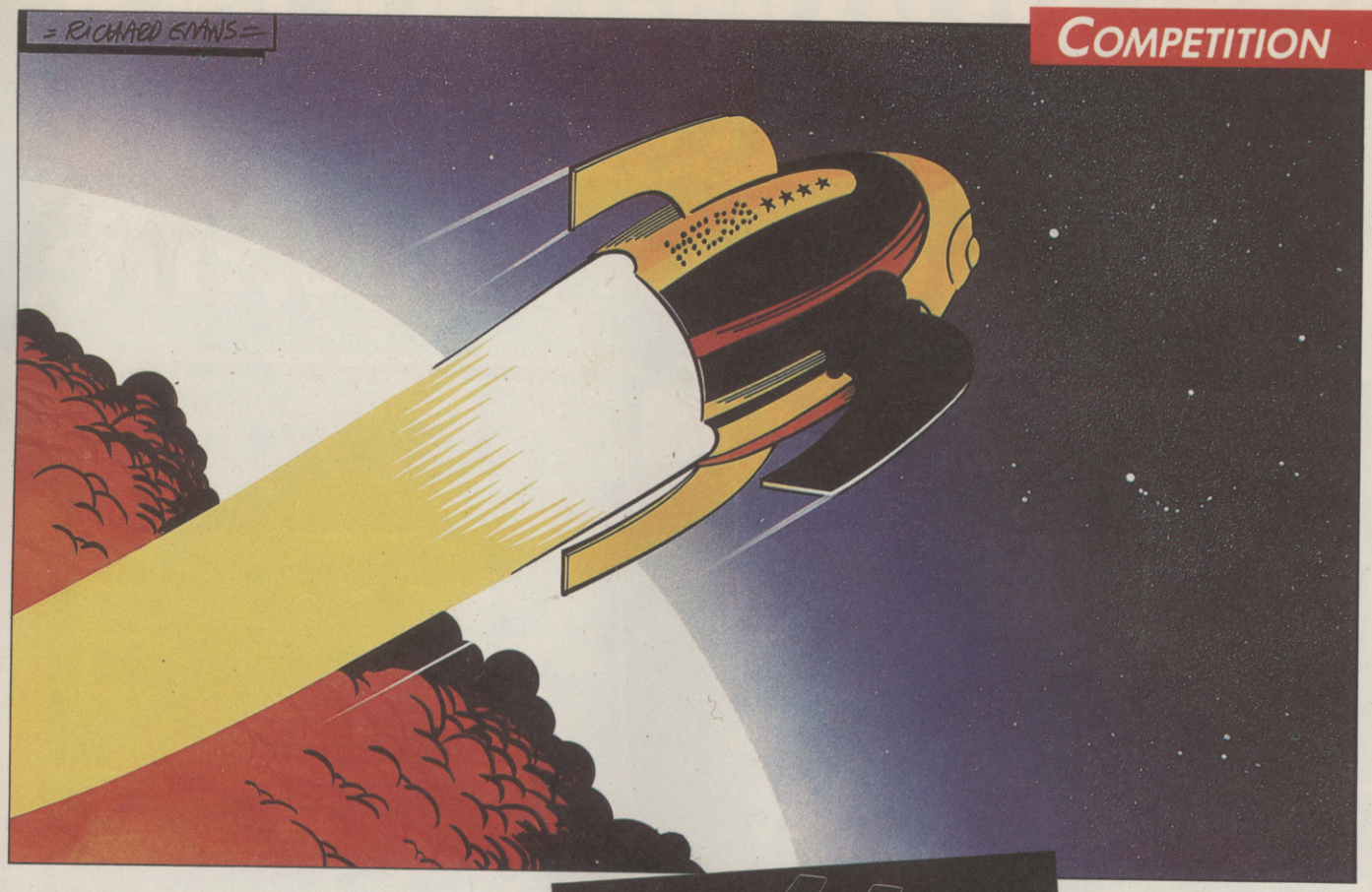
Problem One: You have been given a budget of £300 to spend on these devices (at the prices shown in the box above) as you see fit. You must decide how best to spend the money in order to gain the maximum reliability for the entire system. You must include at least one device at each stage, and you may assume that the switching circuits are free and totally reliable. What is the price and reliability of this optimum system?

Unfortunately, once production starts, the switching circuits turn out to be totally unreliable. Claude offers you some alternative circuits with improved reliability, but you're going to have to pay for them. A list of the costs and reliability of these switching circuits to connect various numbers of devices together are shown in the box right. Quick reference to this shows that the reliability of a switching circuit to connect two devices is 0.99, so that the reliability of Stage 1 with two devices (as calculated in the example above) is actually:
Reliability = $0.99 * (1-(1-0.90)^2) = 0.99 * 0.99 = 0.9801$.

4

Number of devices to be connected:	Price:	Reliability:
1 (no switch)	£0	1.00
2	£2	0.99
3	£4	0.97
4	£6	0.94
5	£8	0.90
6	£10	0.85
7	£12	0.79
8	£14	0.72
9	£16	0.66
10	£18	0.57

That is, the reliability of each stage is the reliability of the parallel devices multiplied by the reliability of the switching circuit.



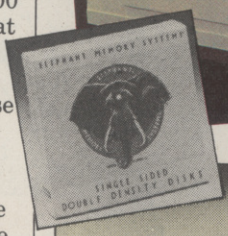
Problem Two: Recalculate the optimum circuit (as in Problem One), but this time take into account the cost and reliability of the switching circuits, shown opposite. What is the price and reliability of the system?

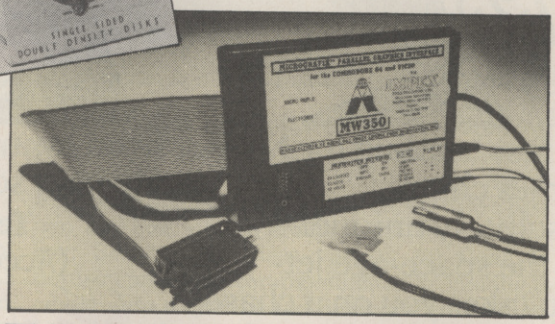
Problem Three: Having finally finished building the MESS, it is found to weigh 400,000 pounds, with empty fuel tanks. It is known that the rocket engines will burn one pound of fuel to raise a weight of 15 pounds by ten feet.

How much fuel is required (at lift-off) to raise the shuttle by 100 feet? Assume that the combined weight of the shuttle and the fuel is recalculated at the end of each 10-foot section.

And that's it. To enter the competition, solve these three problems and put the results on the entry form below. The first correct entry drawn out of the editor's space helmet will win a spanking Panasonic printer and Micrografix interface, so that you can use it with the Commodore 64 or Vic 20. In addition, there are 10 runners-up prizes consisting of a box of Elephant disks and an Elephant teeshirt.

By Marcus Jeffery, technical writer.





The Panasonic KX-P1091 (left) is a sophisticated dot-matrix printer. Using a 9 x 9 character print matrix, it is capable of producing near-letter quality print. Being able to handle both tractor and friction-feed, makes it useful for both programming and word-processing applications. It can print at up to 120 characters per second in the normal draft mode using bi-directional and logic seeking techniques. By combining print modes it is possible to print a total of 64 different character types, including double-width, compressed and superscript / subscript with true descenders. Together with this, the winner will receive an Impex Micrografix MW350 printer interface which allows the printer to be used with your micro, just as if it was a true Commodore printer (see our review in this issue, page 27).

Elephant disks are only recently available in the UK after very successful sales across the Atlantic. Known as Elephant memory disks because they 'never forget', they are certified as being 100 per cent error-free for at least 12 million passes.

ENTRY FORM:

Problem One:

Price: £___.__ Reliability: _.____

How many of device:

1. _____
2. _____
3. _____
4. _____
5. _____

Problem Two:

Price: £___.__ Reliability: _.____

How many of device:

1. _____
2. _____
3. _____
4. _____
5. _____

Problem Three:

Requires _____ pounds of fuel.

NAME: _____ DAYTIME PHONE NUMBER: _____

ADDRESS: _____

_____

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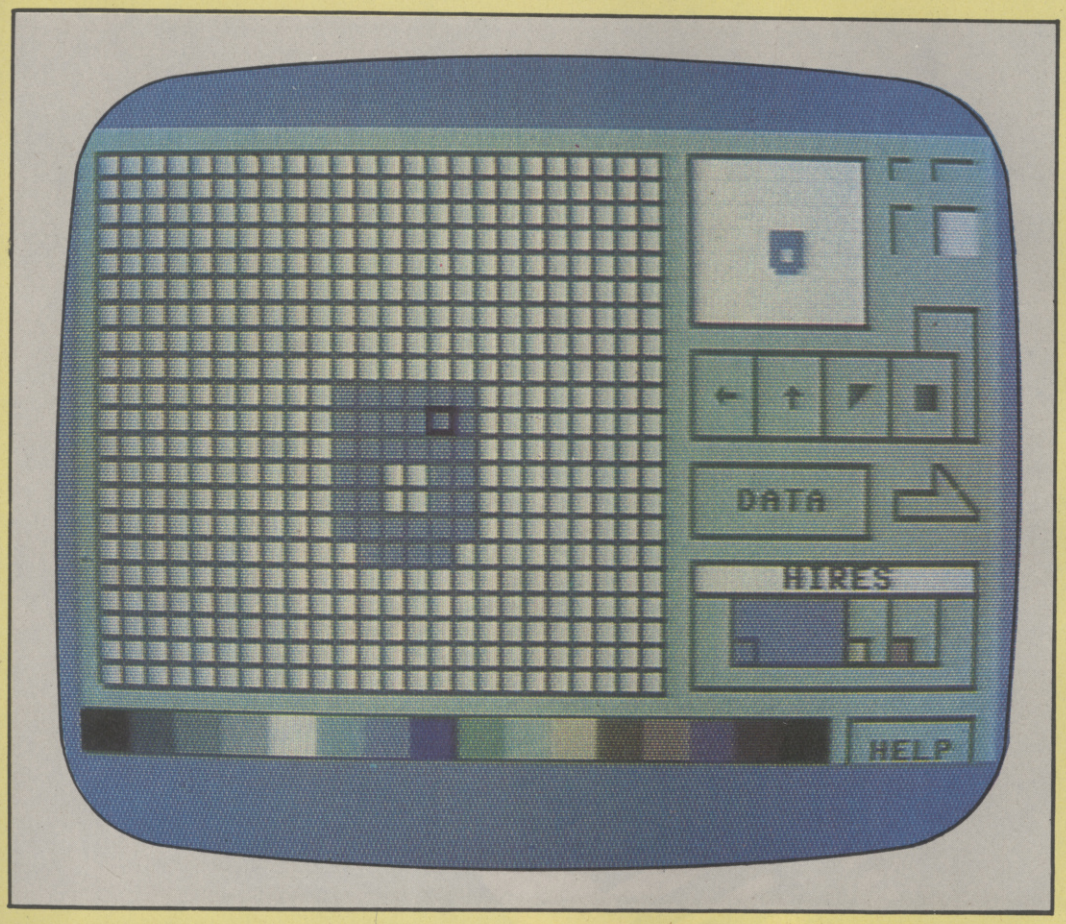
INTO THE SPRITE LIFE

THE 'GO SPRITE' PACKAGE TAKES THE COMMODORE 64'S GRAPHICS ONE FUNCTION BEYOND.



The picture left shows the basic design grid that Go Sprite works from.

There have been several packages aimed at overcoming the Commodore 64's graphics snags by providing utilities to make animation and character design easier; however, each has its quirks, and none is wholly satisfactory. Now Mirrorsoft has entered the field with *Go Sprite,* a package that promises to fill the gap.

Not only does *Go Sprite* improve on character design, but it also adds several new functions — something not to be sniffed at where the 64 is concerned.

Sprites are hi-res programmable objects. Although a character is often termed a sprite, the actual shape is really a character designed by the user, 'hung' on a sprite. In other words, a sprite is a hook on which something can be hung and moved around. These polygoneous creatures pop-up on several machines, but because they rely on hardware control (extra chips or special circuitry) not all have them. This is a shame, as some of their features include automatic collision detection and priorities (allowing one to pass over another). Programs such as *Go Sprite* that help take advantage of these beasts are one of the games programmer's most valuable tools.

All sprite packages offer some kind of drawing pad, but *Go Sprite* offers a virtually complete design package using the grid above. Apart from the usual grid for drawing on, there is a pen box, tool box, stretch group, paint box and help box. Selection of these various functions is implemented in a icon-like fashion by moving a cursor onto a symbol and hitting a fire button/key. Most forms of cursor control have been thought of — joystick, keyboard and light-pen — so no user should feel left out.

Using the pen box, the programmer can switch between hi-resolution and multi-colour modes. Hi-res allows the use of one ink colour with another for background, while multi-colour allows up to three. However, the result of using more colours is a drop in resolution, the pen taking up two dots on the drawing grid instead of one. An eraser is available in both modes, the width corresponding to the pen size.

The pen box supplies the drawing tools, but the tool box provides some special effects to be used on the finished design. For instance, at the press of a button, a character can be made to rotate horizontally, vertically, or both, or appear ▶

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SEQUENCER:
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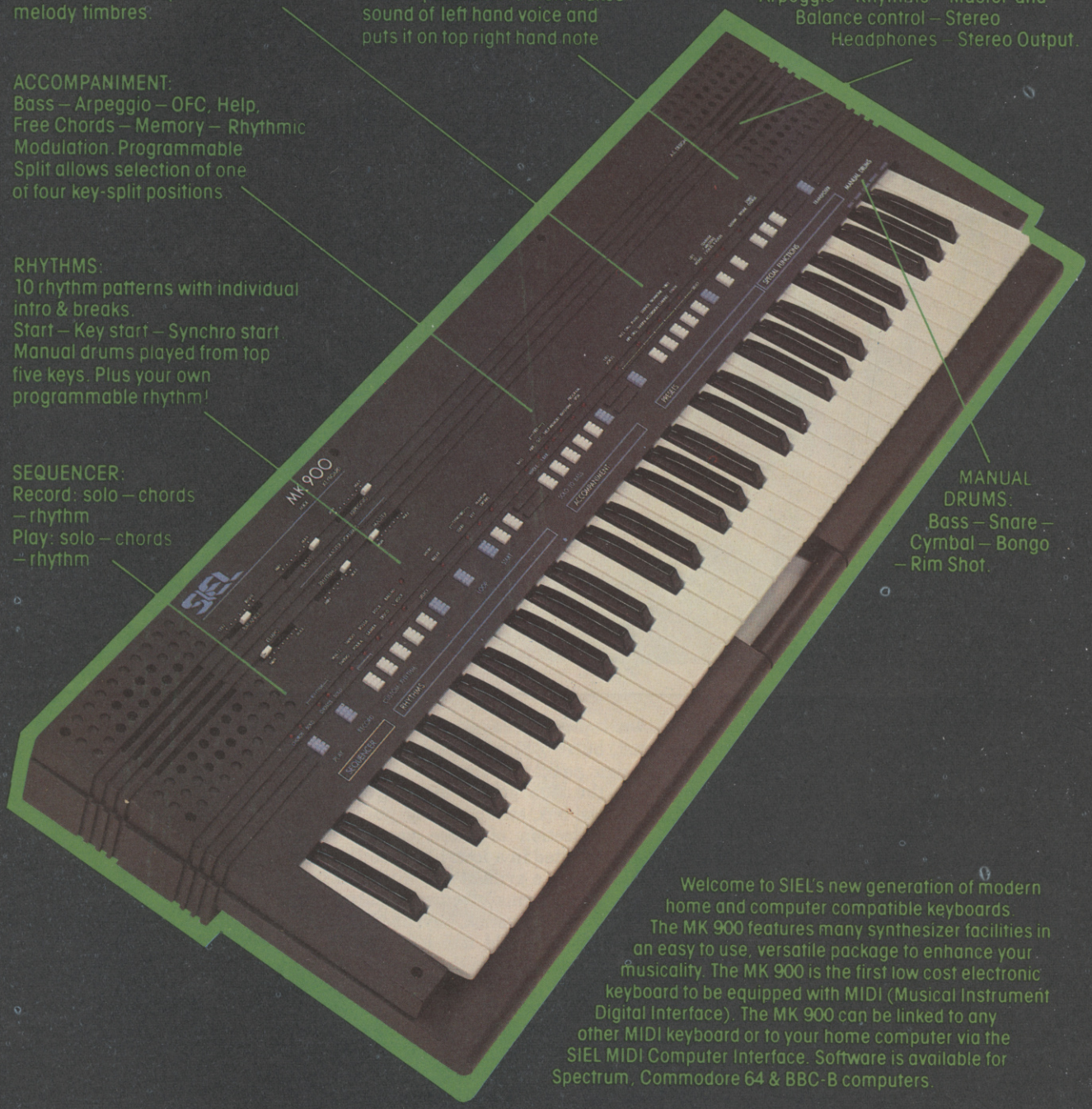
Play: solo – chords – rhythm



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in inverse video. In hi-res mode the inverse function is simple, the background and foreground colours simply swapping over; in multicolour, however, the pen 1 colour swops with pen 2, while pen 3 swaps with the background. Colours should be chosen carefully in this mode to make sure that the sprite is still recognizable in inverse.

The stretch group is a set of functions that affect the outline of a character, somewhat like distorting mirrors found at fun fairs. Using the stretch group, a character can be expanded horizontally, vertically, or shrunk. None of the functions in any of the boxes are irreversible, so the user can mess about with a character to their heart's content.

Once a character has been designed, a second screen (sprite selection, overlaying and copying) can be flicked to. *Go Sprite* is structured like a book, each screen forming a page. Most of the top of the display is taken up with a strip of seven squares, each representing one of 32 possible sprites. The strip is called a 'carousel', and it is used for displaying and selecting sprites. Sprites can be selected by number from the carousel; the drawing pad is then selected so a character can be designed to hang on it.

The basic Commodore 64 does not normally allow any complex overlaying of sprites, but with *Go Sprite* up to seven can be stacked one on top of the other. Using this technique, it is possible to have a multi-layered picture made up of different coloured sprites. To make one sprite overlay another, each is given a priority — one with a low priority will be overlayed by one with a high one. A sprite is assigned a priority by selecting a box from a priority stack. This is a diagonal formed by seven boxes, the top one having the lowest priority.

Three large screens make up *Go Sprite*, the last of which forms an animation facility. It is here the user can see if the sprites gel to produce smooth movement. Running vertically along the left hand side of the display is what looks like a strip of film. A set of sprites can be shown on this, and the film moved to produce some simple animation, reminiscent of cartoons. A now familiar carousel (made up of three windows) is also available for sideways scrolling. Although only 32 sprites are available, the carousel contains 256 spaces, each of which is transferred to the film, forming a sequence of sprites.

Finally, when you have designed your sprites, *Go Sprite* provides a facility that allows them to be stored to tape or disk. Two different selections allow either sets of sprites, or animation sequences, to be saved. Although the edited sprites might look OK, they are not quite ready to be incorporated into a Basic program. First they must be converted into Basic data statements using a program called, appropriately, *Convert*. Once the conversion is complete, LIST will show all the data statements starting at line 10010, leaving enough room before them for a fairly sizeable program.

Go Sprite is one of the most comprehensive sprite designers on the market, and should appeal more to the advanced games designer, as the novice might have some difficulty because colour and movement must be achieved through POKE commands; however all the routines for doing this are provided in *Go Sprite's* manual.

By Steve Applebaum, staff-writer.

One of the most comprehensive sprite designers on the market, Go Sprite should appeal more to the advanced user than the novice.

Go-Sprite (priced £9.95) is available from:
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Holborn Circus,
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PLOTTING YOUR VIC GRAPHICS

GET HI-RES GRAPHICS PLOTS ON THE VIC 20 WITH OUR UTILITY PROGRAM.

One of the commonest sources of frustration for Vic 20 users is in trying to get hi-res graphics out of their machine.

Unfortunately, the *Programmer's Reference guide* doesn't make the process of hi-res plotting very clear; furthermore, the example given in the manual only allows a small area of hi-res to be created.

However, there is a way round the problem. In this short article we will look at using a machine code routine that enables a full bit-map to be set up, and plots/unplots to be made to it.

Fig. 1 contains a machine code program which allows you to set up a full bit-map and plot and unplot points on it. Basic is generally too slow for this purpose due to the large amount of processing required for each point.

The program is assembled at address 8192 ($2,000) and the start of Basic is moved up to the end of the machine code, so that it doesn't ▶

FIG.2

```
14 SYS 8270
15 FORX=0TO175
20 Y=INT(80+79*SIN(X/10))
30 SYS 8376,X,Y
40 NEXT
50 WAIT 198,1
60 SYS8534
READY.
```

Fig. 1 (below) contains out bit-map/plot listing: Fig. 2 (above) is a short sine curve routine.

FIG.1

```
100 C=0
101 READ D$
102 IF D$="END" THEN PRINT D$:END
103 D=VAL(D$):IFD<0 THEN 106
104 X=X+1:C=C+D:POKE 8191+X,D
105 GOTO 101
106 IFC=ABS(D) THEN 100
107 PRINT "ERROR IN BLOCK ";INT(X/64)
108 GOTO 100
110 REM --- BLOCK 1
111 DATA162,0,189,0,16,157,0,30
112 DATA189,0,17,157,0,31,189,0
113 DATA148,157,0,150,189,0,149,157
114 DATA0,151,202,208,229,173,2,144
115 DATA9,128,141,2,144,169,240,141
116 DATA5,144,169,30,141,136,2,169
117 DATA127,160,33,133,43,132,44,169
118 DATA129,160,33,133,45,132,46,133
119 DATA-6618
120 REM --- BLOCK 2
121 DATA47,132,48,133,49,132,50,169
122 DATA110,160,33,76,30,203,160,0
123 DATA169,16,132,20,133,21,162,14
124 DATA152,145,20,136,208,251,230,21
125 DATA202,16,246,169,252,141,5,144
126 DATA173,3,144,41,128,9,21,141
127 DATA3,144,162,0,169,6,157,0
128 DATA150,157,0,151,202,208,245,169
129 DATA-7120
130 REM --- BLOCK 3
131 DATA9,133,251,160,0,132,252,169
132 DATA30,132,20,133,21,162,21,165
133 DATA252,145,20,200,208,2,230,21
134 DATA24,165,252,105,10,133,252,202
135 DATA16,237,56,165,252,233,219,133
136 DATA252,198,251,16,224,169,64,160
137 DATA33,141,0,3,140,1,3,96
138 DATA32,202,32,29,102,33,145,20
139 DATA-7668
140 REM --- BLOCK 4
141 DATA96,32,202,32,93,102,33,145
142 DATA20,96,32,253,206,240,109,32
143 DATA158,215,224,176,176,102,142,52
144 DATA3,78,52,3,78,52,3,78
145 DATA52,3,138,41,7,141,53,3
146 DATA32,253,206,240,79,32,158,215
147 DATA224,160,176,72,142,54,3,78
148 DATA54,3,78,54,3,78,54,3
149 DATA-6204
150 REM --- BLOCK 5
151 DATA78,54,3,138,41,15,141,55
152 DATA3,173,52,3,10,10,24,109
153 DATA52,3,10,24,109,54,3,133
154 DATA20,169,0,133,21,6,20,38
155 DATA21,6,20,38,21,6,20,38
156 DATA21,6,20,38,21,165,21,9
157 DATA16,133,21,174,53,3,172,55
158 DATA3,177,20,96,104,104,162,14
159 DATA-3482
160 REM --- BLOCK 6
161 DATA142,56,3,32,86,33,169,58
162 DATA160,196,141,0,3,140,1,3
163 DATA174,56,3,108,0,3,169,27
164 DATA141,15,144,169,240,141,5,144
165 DATA169,46,141,3,144,96,128,64
166 DATA32,16,8,4,2,1,13,86
167 DATA73,67,32,80,76,79,84,32
168 DATA45,32,79,75,13,0,0,0
169 DATA-4482
170 REM --- BLOCK 7
171 DATA0
172 DATA-0
173 DATA END
READY.
```

interfere with Basic program storage. The character table sits at 4096 ($1000), and the colour table at 38400 ($9600).

Since the text screen is also relocated to $1E00, the computer will be configured like an unexpanded Vic, rather than an expanded one. This reconfiguration has been necessary to protect the bit map from corruption by the text screen.

If you have an assembler you can enter the source code directly *Fig. 3;* otherwise we have included a Basic loader program. Type in the loader and RUN it, having first saved it. If no errors are indicated, then SYS 8192. The program will print 'VIC PLOT – OK' if all is well. Type NEW, and you will have five machine code routines at your disposal.

1: HIRES (NEW) – SYS 8270 sets up a new bit map;
2: HIRES (OLD) – SYS 8291 enables bit map code without clearing the old bit map;
3: PLOT W SYS 8376,X,Y plots a pixel at X,Y;
4: UNPLOT – SYS 8385,X,Y erases a pixel at X,Y;
5: TEXT – SYS 8534 returns the text screen.

X and Y and UNPLOT above may be constants, variables or any legal Basic expression.

Notes on machine code: we have used three Basic ROM routines for parameter input and screen output. These are: $CB1E, which outputs to the screen an ASCII string terminated by zero if high byte of address of string is in Y and low byte in A; $CEFD, which handles a comma from the input buffer, and generates a syntax error if no comma found; and $D79E, which evaluates a parameter (<256) from the input buffer and returns its value in X.

We have also changed the RAM error vector at $0300, so that all errors occurring in bit-map mode return the Vic to text mode so that you can see them. When you have typed in the code you might like to try a short Basic program *Fig. 2* which plots a sine curve using the plot routine.

Bit-mapped graphics don't come as easily to the Vic 20 as to its big brother the 64, where you simply select bit-mapped mode and an area of RAM is designated as a bit-map. Then you just have to dump your data into this area for it to appear on the screen.

The Vic has no bit-mapped mode as such, but it is possible to set up an area of hi-res using the programmable character set. Characters normally derive their pixel pattern information from the ROM character generator. They can instead obtain this data from a RAM table, 8 bytes being required to code each character. The theory is, in easy steps, as follows.

First, you fill the Vic screen with characters arranged consecutively in columns in order of

Fig. 3 (below) contains the source code. It continues onto page 65-66.

FIG.3

```
1030 *=$2000
1040 ;----------
1050 LOOP   = $FB
1060 COUNT  = $FC
1070 SCR    = $14
1080 ;---------------
1090 ;--ENABLE PROGRAM--
1100 ;---------------
1110 HRS LDX #$00      ;
1120 PUT LDA $1000,X   ;
1130     STA $1E00,X   ;COPY OLD SCREEN
1140     LDA $1100,X   ;CONTENTS TO NEW
1150     STA $1F00,X
1160     LDA $9400,X
1161     STA $9600,X   ;COPY OLD COLOUR
1162     LDA $9500,X   ;TABLE TO NEW
1163     STA $9700,X
1164     DEX
1165     BNE PUT
1180 ;----------
1190     LDA $9002     ;RELOCATE TEXT
1200     ORA #$80      ;SCREEN TO $1E00
1210     STA $9002     ;(SAME AS
1220     LDA #$F0      ;UNEXPANDED VIC)
1230     STA $9005
1240     LDA #$1E      ;INFORM BASIC OF
1250     STA $0288     ;NEW SCREEN PAGE
1260 ;----------
1270     LDA #<SOB+1
1280     LDY #>SOB+1
1290     STA $2B       ;SET START OF
1300     STY $2C       ;BASIC
1310     LDA #<SOB+3
1320     LDY #>SOB+3
1330     STA $2D       ;SET START OF
1340     STY $2E       ;VARIABLES
1350     STA $2F       ;SET START OF
1360     STY $30       ;ARRAYS
1370     STA $31       ;SET END OF
1380     STY $32       ;ARRAYS
1390 ;----------
1400     LDA #<CRD     ;
1410     LDY #>CRD     ;PRINT OK
1420     JMP $CB1E     ;MESSAGE
1430 ;---------------
1440 ;--FILL CHAR TABLE WITH ZEROES--
1450 ;---------------
1460     LDY #$00
1470     LDA #$10
1480     STY SCR
1490     STA SCR+1
1500     LDX #$0E
1510     TYA
1520 RAJ STA (SCR),Y
1530     DEY
1540     BNE RAJ
1550     INC SCR+1
1560     DEX
1570     BPL RAJ
1580 ;---------------
1590 ;--SET UP VIC CHIP--
1600 ;---------------
1610     LDA #$FC      ;SET CHAR. TABLE
1620     STA $9005     ;TO $1000
1630     LDA $9003     ;SHORTEN SCREEN
1640     AND #$80      ;TO 10 ROWS AND
1650     ORA #$15      ;SET 8 / 16 CHARS
1660     STA $9003     ;
1670 ;---------------
1680 ;--FILL COLOUR TABLE WITH 'BLUE'--
1690 ;---------------
1700     LDX #$00
1710 GET LDA #$06      ; 6=BLUE
1720     STA $9600,X
1730     STA $9700,X
1740     DEX
1750     BNE GET
1760 ;---------------
1770 ;--FILL SCREEN WITH CHAR SET--
1780 ;---------------
1790     LDA #$09      ;10 ROWS (0-9)
1800     STA LOOP
1810     LDY #$00      ;CHARCOUNTER
1820     STY COUNT
1830     LDA #$1E      ;INITIALIZE
1840     STY SCR       ;SCREEN POINTER
```

screen codes; you then set aside an area of RAM to contain the pixel definitions for the characters on the screen; now, make the characters comprising the screen get their pattern information from your RAM character table. Then, by switching on a bit in your RAM character table area, you light up a pixel in one of the characters comprising the screen. The exact position of this pixel on the screen will depend on how you have arranged your characters.

This, however, turns out to be a little trickier than it sounds because of several restrictions imposed by the Vic. For example, to fill a full Vic screen would require 506 characters, and yet there are only 256 unique characters available to us. This problem can be solved be setting the VIC chip to DOUBLE SIZE CHARACTER mode.

In this mode each character is composed of 8 × 16 pixels instead of 8 × 8, and thus occupies twice the area on the screen. Also, each character now requires 16 bytes in the RAM character table to code it. The problem now is that the screen goes off the bottom of the TV picture, so we have to reduce the number of screen rows by half.

Another problem is that the VIC chip requires that all CHARACTER TABLE and SCREEN TABLE data be stored in the 4K RAM area between 4096 ($1000) and 8191 ($1FFF). To bit-map the whole Vic screen would require 253 * 16 or 4048 bytes of this area for the character table alone, leaving no room at all for the screen table. To make room for a screen, we have to reduce the size of our bit-map, and is going to have to be smaller than a text screen by 66 characters.

Once we have set up our bit-map, we need to be able to work out which bit to address in our character table for a given pixel on the screen. As said, this will depend on how the characters are arranged on the screen. We have followed the convention in the *Programmer's Reference Guide*, for instance, in order of screen codes given right.

Using this convention for a full 220 character bit-map, the address of the bit controlling a pixel at co-ordinates x,y where the origin is at the top left of the screen is calculated thus: the CHARACTER CODE is given by CHARACTER = INT(X/8)*10 + INT(Y/16); the ROW in the characer is ROW = Y AND 15; the byte is therefore BYTE = CHARACTER* 16 + ROW + TABLE BASE ADDRESS; the bit in that byte is BIT = X AND 7.

By John Gibbons, a freelance programmer.

Input Codes:

0	10	20	30... 210
1	11	21	31... 211
2	12	22	32... 212
"	"	"	"
9	19	29	39

```
1850      STA SCR+1      ;($1E00)
1860 ;----------
1870 L0   LDX #$15       ;22 COLS (0-21)
1880 L1   LDA COUNT      ;(HEX $15)
1890      STA (SCR),Y
1900      INY
1910      BNE L2
1920      INC SCR+1
1930 L2   CLC
1940      LDA COUNT      ;ADD 10 ($0A) TO
1950      ADC #$0A       ;CHAR COUNTER FOR
1960      STA COUNT      ;NEXT COLUMN
1970      DEX            ;
1980      BPL L1
1990      SEC
2000      LDA COUNT      ;SUBTRACT 219
2010      SBC #$DB       ;($DB) FOR NEXT
2020      STA COUNT      ;ROW
2030      DEC LOOP
2040      BPL L0
2050 ;--------------
2060      LDA #<EX2      ;CHANGE ERROR
2070      LDY #>EX2      ;VECTOR
2080      STA $0300
2090      STY $0301
2100      RTS
2110 ;--------------
2120 ;--PLOT ROUTINE--
2130 ;--------------
2140 PLT  JSR XCO        ;'OR' MASK INTO
2150      ORA MSK,X      ;CHARACTER BYTE
2160      STA (SCR),Y
2170      RTS
2180 ;--------------
2190 ;--UNPLOT ROUTINE--
2200 ;--------------
2210 UPT  JSR XCO        ;'EOR' MASK OUT
2220      EOR MSK,X      ;OF CHARACTER
2230      STA (SCR),Y    ;BYTE
2240      RTS
2250 ;--------------
2260 ;--GET IN X-COORDINATE--
2270 ;--------------
2280 XCO  JSR $CEFD      ;GET COMMA
2290      BEQ EX1        ;IF END - EXIT
2300      JSR $D79E      ;GET PARAMETER
2310      CPX #$B0       ;COMP TO X-LIMIT
2320      BCS EX1        ;IF >= - EXIT
2330      STX $0334
2340      LSR $0334      ;
2350      LSR $0334      ;INT(X/8)
2360      LSR $0334      ;
2370      TXA            ;
2380      AND #$07       ;X AND 7
2390      STA $0335      ;
2400 ;--------------
2410 ;--GET IN Y-COORDINATE--
2420 ;--------------
2430 YCO  JSR $CEFD      ;GET COMMA
2440      BEQ EX1
2450      JSR $D79E      ;GET PARAMETER
2460      CPX #$A0       ;COMP TO Y-LIMIT
2470      BCS EX1
2480      STX $0336
2490      LSR $0336      ;
2500      LSR $0336      ;INT(Y/16)
2510      LSR $0336      ;
2520      LSR $0336
2530      TXA            ;
2540      AND #$0F       ;Y AND 15
2550      STA $0337      ;
2560 ;--------------
2570 ;--CALCULATE POINTER INTO CHAR
2580 ;TABLE--
2590 ;--------------
2600      LDA $0334      ;
2610      ASL A          ;
2620      ASL A          ;INT(X/8)*10
2630      CLC            ;
2640      ADC $0334      ;
2650      ASL A
2660 ;----------
2670      CLC            ;
2680      ADC $0336      ;+INT(Y/16)
2690      STA SCR        ;
2700      LDA #$00
```

FIG.3 CONT.

```
2710      STA SCR+1
2720 ;----------
2730      ASL SCR       ;
2740      ROL SCR+1     ;
2750      ASL SCR       ;
2760      ROL SCR+1     ;*16
2770      ASL SCR       ;
2780      ROL SCR+1     ;
2790      ASL SCR       ;
2800      ROL SCR+1     ;
2810 ;----------
2820      LDA SCR+1     ;'OR' IN CHAR
2830      ORA #$10      ;TABLE BASE ADDRS
2840      STA SCR+1     ;
2850 ;----------
2860      LDX $0335     ;X AND 7
2870      LDY $0337     ;Y AND 15
2880      LDA (SCR),Y   ;GET BYTE FROM
2890      RTS           ;CHAR TABLE
2900 ;--------------
2910 ;--ERROR EXIT--
2920 ;--------------
2930 EX1 PLA            ;CLEAN UP
2940      PLA           ;STACK
2950      LDX #$0E      ;'ILLEGAL
2960 EX2 STX $0338      ;ARGUMENTS' CODE
2970      JSR TXT       ;TEXT MODE
2980      LDA #$3A      ;RESET SYSTEM
2990      LDY #$C4      ;ERROR ROUTINE
3000      STA $0300     ;
3010      STY $0301     ;
3020      LDX $0338     ;EXIT VIA SYSTEM
3030      JMP ($0300)   ;ERROR ROUTINE
3040 ;--------------
3050 ;--RESET VIC CHIP DEFAULTS TO
3060 ;RE-ESTABLISH 'TEXT MODE'--
3070 ;--------------
3080 TXT LDA #$1B
3090      STA $900F
3100      LDA #$F0
3110      STA $9005
3120      LDA #$2E
3130      STA $9003
3140      RTS
3150 ;--------------
3160 ;--BIT MASKS--
3170 ;--------------
3180 MSK .BYTE $80,$40,$20,$10
3190      .BYTE $08,$04,$02,$01
3200 ;-----------
3210 ;--POWER-UP MESSAGE--
3220 ;-----------
3230 CRD .BYTE $0D
3240      .ASC "VIC PLOT - OK"
3250      .BYTE $0D,00
3260 ;-----------
3270 ;FIRST 3 BYTES OF BASIC
3280 ;-----------
3290 SOB .BYTE $00,$00,$00
3300 ;-----------
3310 .END
READY.
```


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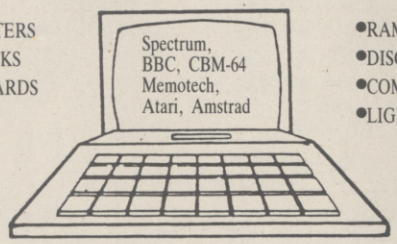

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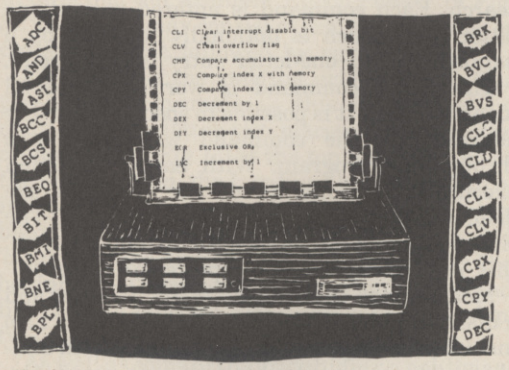


The advantages of machine code over Basic are well-known: though more difficult to use, it is much faster in operation, and therefore gives much improved results.

The Commodore 64 is no exception in this, yet it has hardware and software facilities that, if used correctly, can produce amazing results. Two such features are the SID and VIC chips, which can be considered as separate processors in their own right. Both the SID (Sound Interface Device) and VIC (Video Interface Controller) chips are difficult to use from Basic, but, when using these devices with machine code, the setting of sound and sprite registers becomes second nature.

The answer, then, is to program in assembly language. Even though the Commodore 64 was not designed as a machine-code development system, it can be made to act as one, providing the right hardware and software is chosen.

Writing in assembly language the 'proper' way involves a lot more than simply loading an assembler and bashing away at the keyboard. Assembly language programming takes considerably longer than Basic, and needs a lot more thought beforehand. The right gear is essential, and two items of great value are a decent monitor and printer.

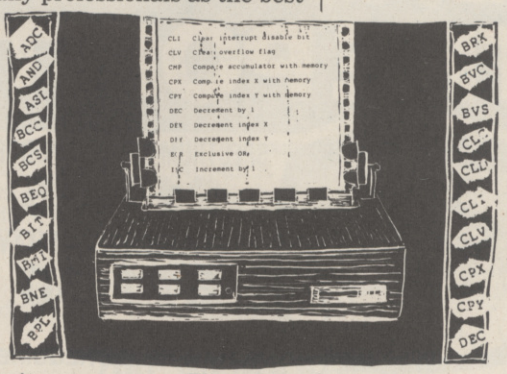
Commodore produce their own 1701 control monitor for the 64. This differs from most monitors in that it produces sound as well. The picture is very sharp, and a definite improvement compared to a standard TV set. However, in the actual writing of assembly language, colour is not that important. In this case, it is better to buy a green-screen monitor, which will reproduce characters with a sharper definition, such as the Phillips 12 inch monitor.

No one in their right mind is going to develop a lengthy program without a printer. This is simply because it is easier to debug a program if a listing is at hand. Commodore produce the MPS-801 dot matrix printer for £230. It is rather slow and noisy, but it does reproduce the 64's character set. For £345 you can get the MPS-802 model which gives better quality.

An alternative to using the Commodore range of printers is to use a printer interface cable that will allow you to use your own printer with the 64. One of the best (and more expensive) is the Micrografix Interface (reviewed on page 27), which allows you to connect the 64 to a Centronics-type printer. This allows for the emulation of the MPS range of printers, and it also includes a feature which converts Commodore control codes into readable English.

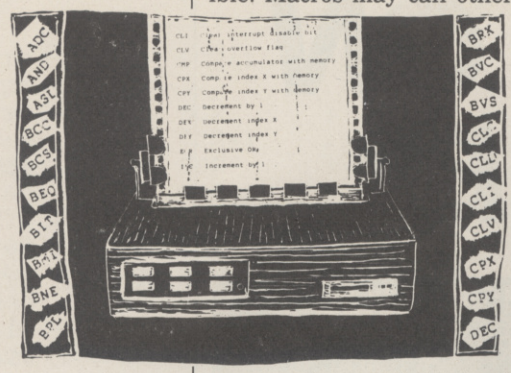
The final hardware item to consider is a disk drive. This is probably the most expensive peripheral you will buy, but also the most essential (note that many of the more powerful assemblers require disks). Commodore's 1541, costing around £200, is not very fast. Many manufacturers have produced software/hardware that speeds up the operation of the 1541, but be warned — you should check that your particular software will be compatible before buying the 1541.

Considered by many professionals as the best machine language development tool for the 64, the *ASM 6640 Macro Assembler Development* system from Commodore is highly rated. For your money you get a disk with all the utilities you are likely to need, including a macro assembler, editor, loader, and two monitor programs. The whole package is quite sophisticated in places, and we would not recommend it for those who merely wish to potter about.



One of the programs on the *ASM 6640* is a 'wedge' which once loaded amends the operating system and Basic interpreter and provides the user with simplified disk housekeeping commands. Creating source code for the assembler is done by using the editor. This operates almost exactly like the Basic editor, with the exception that text is stored in ASCII and not tokenised.

Once the soucre code has been prepared, it can be assembled. The assembler can produce a cross reference file as well as the object file. There are options to produce hard copy, and we found the process of assembling easy to follow. The big plus with *ASM 6640* is that it is possible to ▶



produce 'macros', and thus building a library of common routines is perfectly feasible. Macros may call other macros, and up to nine levels are permitted.

Pro-Line PAL 64 (Personal Assembly Language) has fewer compared with the *ASM 6640*, yet it is quite comprehensive and easy to use. One of the major features of *PAL* is the format in which source code is entered: once *PAL* is loaded, all source code is entered in a free format, and it is even possible to have more than one instruction per line. To actually assemble the code, RUN is entered and a SYS call is made to the assembler which then assembles the code.

No cross reference file is produced, but the source code will appear neatly formatted. This can be saved to tape or disk. Upon successful assembly, each line number will be followed by the address corresponding to that particular instruction, also displayed is the hex bytes corresponding to the instruction, along with the opcode itself. Various pseudo-ops are provided, and in general *PAL* follows the standard mnemonics quite well.

Besides the standard version of *PAL*, a relocatable one is provided which will relocate existing object code. This means that you do not have to re-assemble a large program if it needs to be moved about in memory. As previously mentioned, *PAL* does not offer many of the more sophisticated commands that other assemblers offer, yet it only takes up a little over 4K of RAM, and together with the various debugging tools provided on the system disk, it provides a quick and easy way to program in assembler.

Both the assemblers reviewed come with several debugging aids such as the popular (yet simple) Supermon. A machine-code monitor will allow you to examine areas of memory, display it in several formats, and so on. Using a monitor in conjunction with a good assembler will allow the programmer to develop and debug a machine code program quickly and easily.

Hes Mon 64 is supplied on cartridge and provides 31 commands. All the typical ones are included, such as memory fill and byte/string search. Each command is entered with a one letter code which is optionally followed by a parameter. This one-letter entry is very useful.

The WALK command is worthy of special mention. Here, it is possible to specify a starting address and the command will single-step through the program. With each instruction executed, the contents of the registers are displayed as well as the instruction itself. The single-stepping can be speeded up, and all in all, this is probably the most powerful feature.

Memory may be displayed in ASCII or hex and a dissassembler is also provided. *Hes Mon* also includes an output divert command which simply diverts screen output to disk, tape, or printer. A similar command allows a copy of the screen to be sent to a selected device.

By David Janda, a computer journalist.

All of the products mentioned in this article are generally available through retail suppliers; here, however, is a price guide: Commodore 1541 disk drive and Commodore 1701 colour monitor, are both priced £195.95; Phillips 12-inch green-monitor is priced £79; MPS801 dot-matrix printer is priced £230; MPS802 quality dot-matrix printer is priced £345; PAL 64 is priced £57; ASM 6440 is priced £24; Hes Mon 64 is priced £39.94; Impex printer interface is priced £89.95

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Fig. 1 shows the starting grid, and *Fig. 2* is given as an example — this is obtained by shifting every letter two places forward in the alphabet from *Fig 1*. On the top line, starting at the first position, the L in *Fig 1* has become an N in *2*, the N in *1* has become a P in *2*, and the X has become a Z, and so on. Where letters would 'overshoot' the alphabet, they start again at the beginning. Thus the Z in *Fig. 1* on the second line, second position along the line, moves 'up' two places to become a B in *Fig. 2*.

As well as some of the grids hiding a politician, each grid has a code number, (*Fig 3*) which is simply the sum of all the ASCII codes of the letters in that grid. (In the ASCII system, the code for A is 65, for B is 66 . . . through to 90 for Z.). The code numbers of all the grids hiding a politician are given below the diagrams.

The cabinet draws lots to choose a Prime Minister, and this herculean task is given to the politician who's name is hidden in the grid with code number 7813.

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Crozzle set by Henry Howarth.

1:
2:
3:
4:
5:
6:
7:

Send to: *Commodore Answers* editorial, Computer 'Crozzle', 62 Oxford Street, London W1A 2HC. The £15 prize winner will be the first correct entry drawn from a hat. The Editor's decision is final. Closing date 30 December, 1984. Winners will be notified by post.

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Fig. 1:

```
LNXSRCFIRR
RZJHYNPSSD
UIBUDIFSEQ
TVIEBJQDSN
CKJYJFLOAA
LQYCYPAIQZ
MAFNMUCJJM
RXPBIHTBNU
WGEDXMOSIR
AUCLMPZYCF
```

Fig. 2:

```
NPZUTEHKTT
TBLJAPRUUF
WKDWFKHUGS
VXKGDLSFUP
EMLALHNQCC
NSAEARCKSB
OCHPOWELLO
TZRDKJVDPW
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Fig. 3: Code numbers: 7673, 7813, 7729, 7661, 7709, 7775, 7711.

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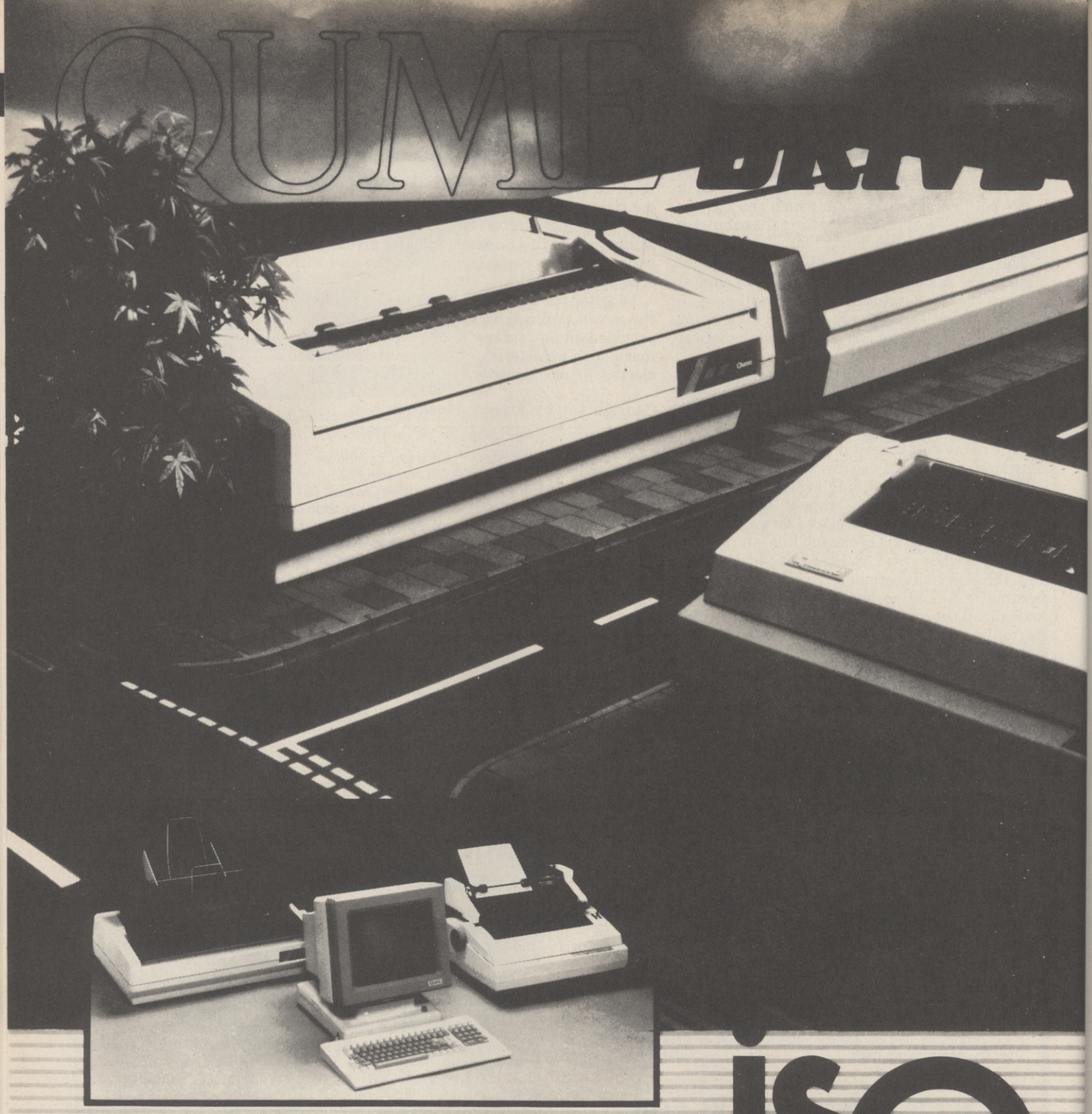

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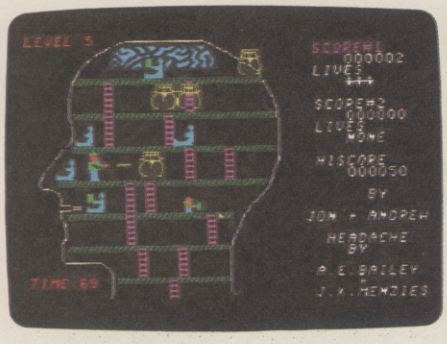

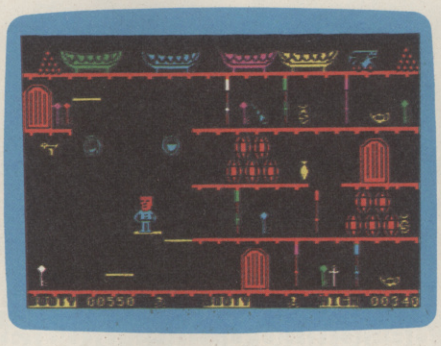

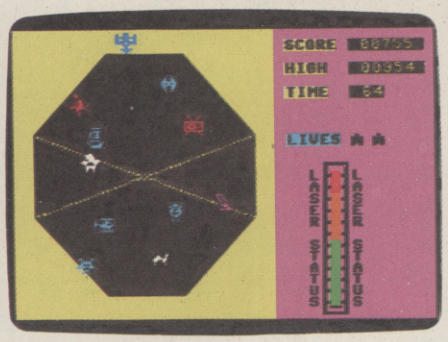

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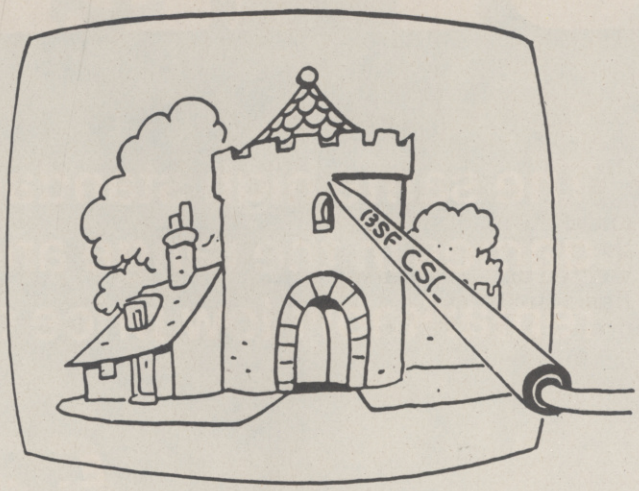

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BASIC COMPARISON

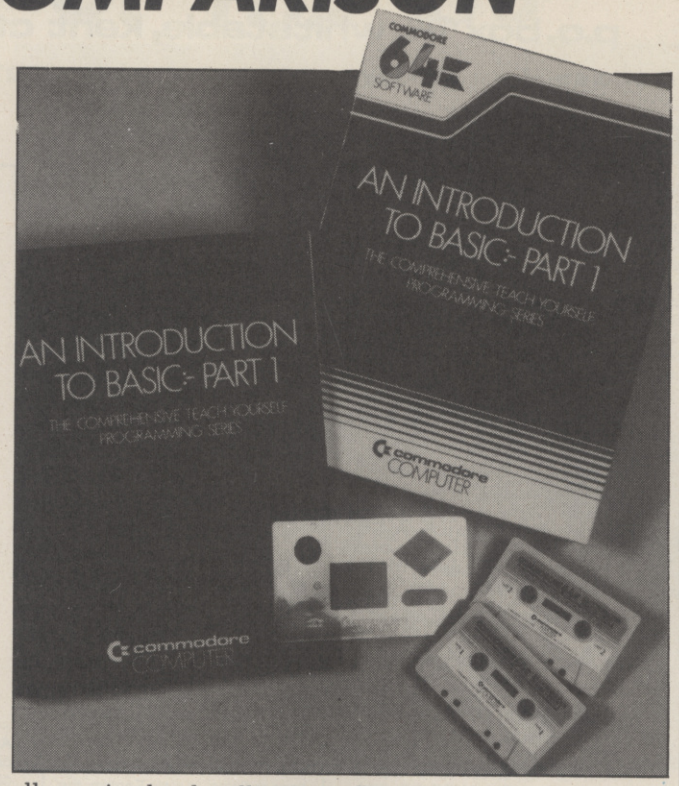
I have been using structured Basic on a mainframe so I am looking for a computer which uses structured Basic. Although the BBC has a great Basic, I think it is overpriced. The Commodore 64 has interested me most, but I would prefer using Simon's Basic.

Does Simon's Basic make the 64 as good as the BBC? Will programs written using Simon's Basic run on an ordinary 64? Will a 64 compiler be able to compile Simon's Basic which could then run on an ordinary 64?

Andrew Scott, By Broughty Ferry

You're right that, in current market terms, the BBC Model B is overpriced. However, a Simon's Basic cartridge does not make the Commodore 64 the equal of a BBC Model B in software terms. Simon's Basic has some structural constructs, but is really more of a toolkit which allows simpler handling of graphics and so on. You cannot run Simon's Basic programs on a 64 without the Simon's cartridge.

We don't know of any plans to produce a Simon's Basic compiler.



HOW TO GET FLASHING

Is there any specific SYS call or POKE that controls something to flash on the Commodore 64? Also, could you list some handy PEEKs and POKEs? Is there a way to display something on the screen while a game or program is loading?

Gary McDonagh, Manchester.

There is no specific POKE you can use to flash the screen. The only way which this can be done simply is to use direct POKEs to the screen memory with two alternative character codes.

For example, a POKE of 65 will give an 'A' in the specified position of the screen. If this is followed by a POKE of 32 to the same location, then the 'A' will be replaced by a space.

In other words, the A will disappear.

Successive POKEs of 65 and 32 will then cause the 'A' to flash on and off.

You will need to experiment with various delay times to control the frequency of the flashes. Incidentally, direct POKEs to the screen produce characters only with ROMs of version 3.0 and onwards. With ROMs prior to this, you need to POKE the colour code in the corresponding colour memory as well.

To display something on the screen while a program is loading is difficult. In cassette mode, using the normal Basic load, the screen display is turned off, since otherwise the CPU cannot respond fast enough.

Using the 1541 disk drive, the screen display is turned on and it is possible to display a stationary picture by saving the screen memory as well as the program. (You would need to use a monitor to do this, of course.)

If you SAVE from 1024 to the end of your Basic or machine-code program, and LOAD using LOAD "filename", 8, 1, then your picture will reappear on loading. This is the technique used by *Easy-Script*, for example.

A lot of the turbo loaders on the market also display images on the screen while loading, but these use their own specific tape handling routines to improve on Commodore's rather slow ones.

UPGRADE CHOICE

I had a Spectrum 48K but I got bored with just playing games, so I sold it. I am wondering whether to get a Lynx or Commodore 64: which one would be the best to buy?

Darren Walker, London.

You'll find a Commodore 64 difficult to program after using a Spectrum. For example, there's no direct way to generate high-resolution lines or circles on the 64. This has to be done by a fairly complex sequence of POKEs.

The keyboard is, of course, much more professional however, and, once you've mastered the technique of using POKEs for almost every function in the graphics and sound area, the 64 becomes a very powerful machine.

ANSWERS

PRINTER PROBLEM

I recently bought a Vic 1320 printer / plotter for my Commodore 64. When I try to connect it, I get a frustrating message: DEVICE NOT PRESENT. I have used only the cable supplies, and followed the instructions in the manual OK, but still I get the same reply from my micro — why?

Ahmed Abd Aziz, Hull.

From what you say it seems likely that a handshaking line is disconnected; however, it is difficult to diagnose the fault at long range.

We suggest you return the device and all its bits and pieces to your dealer for a thorough check; as it is just conceivable that the fault is with the 64 itself, it would be as well to take that along as well.

FAMILY CONVERT

Is it possible to convert my Vic20 to a Commodore 64, via a cartridge for instance? If it is possible, can you give me the addresses I will need to know to convert my Vic, or instead can you print the circuit I'd need to do it myself?

I have too much software for the Vic to just swop computers, and I can't afford both.

Thomas Liversage, Kidbrooke.

It is not possible to convert a Vic20 to a Commodore 64. The internal architecture of the two machines is completely different. The only possible way to get a Commodore 64 is to buy one! We suggest that you try to sell your Vic20.

Unfortunately, it is extremely unlikely that much of your current software will work on the Commodore 64 since so many important POKE addresses are different. Also, the screens have a different format on the two machines.

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Diskey gives your Commodore 64 the file handling and disk editing capabilities a serious user needs. Copy SEQ, PRG or USR files with ease. Allows you to examine, copy, or modify any disk. Rescue data from a crashed disk, or simply recover scratched files. For one or two disk units. Also available, for single disk users, is the slightly less versatile but no less powerful SUPERDISK UTILITY (£13.50).

PAPERCLIP
£75

(Batteries Inc) – disk

LOOK AT OUR LOW, LOW PRICE! If you've been saving up for a wordprocessing program then this is the one to get. For those that actually do know, this is still the best in a very strong field. With 80-column display mode. Can be used with 80-column board (£99). Full selection of other WP programs available.

MULTIPLAN
£95

(Microsoft/Hesware) – disk

Easy to use but very powerful spreadsheet. Option to define cells by word labels. Sorts columns / rows numerically or alphabetically. Output to Commodore printers only. Very highly recommended. (Companion books on its use available.)

CALCRESULT
£95

(Handic) – cartridge+disk

Has true 3D (multipaging) facility and histogram features. Versions for Commodore and Epson printers. This is a very powerful and much respected spreadsheet. Single page version £47.50 (cartridge).

MIKRO ASSEMBLER
£55

(Supersoft) – cartridge

Features three pass assembler, unlimited labels, source files can be linked, monitor, screen editor, disk or tape, operation. Plus AUTO, DELETE, FORMAT, FIND, NUMBER, DISASSEMBLE, OUT and TABLE. Monitor has standard TIM commands plus hunt, transfer and disassemble.

HS-64 ASSEMBLER DEVELOPMENT SYSTEM
£55

(JCL Software) – cart+disk

Cram-packed with all the features you need to write machine code, BASIC and hybrid programs. Cartridge and disk with assembler, editor, DOS support and a sophisticated monitor. Disk includes assembler and worked examples which you may be able to link to your own programs. Features include AUTO, FIND, CHANGE, DELETE, TYPE, GET, PUT, DO, LIST, RENUM, JOIN, SCROLL, CBM, ASCII, RBAS, SIZE, SETBRK, CLRBRK, BOOM, and number system conversions. And there's a great deal more – including a line insertion feature! This is the most versatile assembler toolkit available for the 64 – the one that the chaps at Corby use! A special deluxe version with the assembler also on ROM is available (£POA).

KOALAPAD
£80

(Koala Tech Corp) – cart or disk

This really is a great device for getting even the youngest of kids to relate to the computer – but capable of much else and fun for the whole family! Comes complete with KoalaPaint which is fantastic for graphics. Facilities include zoom, copy, colour swap, draw, lines, rays. Pictures can be saved to disk, incoporated within your own programs! Programmers Guide – disk £14 – outlines ways in which the pad may be used and explains programming needed. Support programs (disk) include LOGO Design Master (£33), Spelling (£33), Colouring (£25). Other 'pads' are available.

MICRO-SIMPLEX
£173

(Micro Simplex) – disk

If you're in a cash business and need to maintain an accurate audit trail and VAT record, this is the program for you! Will save hours of paperwork. Fully recognised by the authorities – it's based on the Simplex book-keeping system. Suitable for schemes A to F. Demo available.

THE LAST ONE
£57.50

(DJ 'A1' Systems) – disk

SPECIAL OFFER PRICE!!! Program generator that frees you from the drudgery of writing tailor-made data management programs. Create commercial, sellable database programs with ease. TLO creates standalone error-free coding in standard BASIC which can then be compiled if required (PETSPEED £50). Input is in the form of one-line descriptions defining, in plain English, the user's requirements. Programs you create can be for any application and as simple or as sophisticated as you like. Very, very highly recommended – BUT HURRY!

S.A.M.
£48

(Tronix) – disk

This is SOFTWARE AUTOMATIC MOUTH, a quite outstanding piece of software which gives your 64 limitless speech synthesis capability. Offers English text-to-speech or phonetic input, in direct or program modes. Full control over pitch, speed, inflexion. Expensive maybe, but there's nothing like it, even on hardware!

SUPERBASE 64
£48

(Precision) – disk

Really excellent database management program, still at our special price. This one's the best of its type and a must for all serious 64 users. Can be used for anything from mailing lists to stock control and invoicing. Lets you tailor a database, its prompts and displays to your exact requirements although the core program always remains the same. Has database features that are easy to use yet powerful beyond the needs of mere mortals! STEPPING STONE and HOMEBASE application modules – for use with Superbase – also now available. Details on request.

FLIGHT SIMULATOR II
£40/£33

(Sublogic) – disk or tape

This is so good the authors think you can learn 'the ropes' as far as instrument control and flying are concerned! Whatever, the simulation is quite excellent. Expensive but it's the best on for the 64 by far – and a MUST for the collection!

SPECIAL OFFERS

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LOGO
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EASY CALC 64
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MAGIC DESK
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SIMONS BASIC
(r) £45
EASY SPELL (US)
EASY MAIL
(d) £20

Superbase and Paperclip bought together: £155!

Amongst the more obscure items we can supply are: XL80 eighty-column cartridge for professional wordprocessing. Has own text editor AND spreadsheet. Excellent value at £99. A parallel bus interface for the 1541 floppy drive! This speeds up data transfer by over five times! Includes cable, interface and relocatable software – price is £75. ● IEEE interfaces – JCL (£68) or DAMS)£62) – to connect your 64 to CBM printers and drives. Fancy a magabyte or two of disk storage – that's how we use some of our 64s! ● Printer interfaces which range from user port parallel cables (£29 including software) – to a cartridge-port conversion interface (the very sophisticated Grappler CD £100, or Data 20's at £55) which enables most dot matrix printers to print the special Commodore ROM graphics symbols for program lists or graphics outputs. Let us help you choose properly!

BOOKS

There are some 64 books specifically about the 64! We have a full list (50p) with a description of each, plus details of many other books of interest. We can supply ANY book at cover price plus 75p each towards P&P.

ANATOMY OF THE 1541
£14.95

Really excellent book for those keen to get to grips with 1541 use. Absolutely everything you need to know – includes ROM listings, use of programs such as COPYALL on the test/demo disk.

COMMODORE 64 HOME COMPANION
£10.95

If you want more details and explanations on the use of some of the better quality 'serious' USA software for the 64, this book is an invaluable source of reference.

PRICES CORRECT AT TIME OF GOING TO PRESS. Let us quote you if you manage to find lower!

DESTINY OF THE C16

Is the Vic 20 going to be replaced by the new Commodore 16 — in other words, is it going to go out of production?

B Anderson, Lincs.

The Commodore 16 is indeed due to ultimately replace the Vic 20, which is rapidly looking out of date owing to its small memory and unique screen size. The Commodore 16 is, like the old Vic20, designed for the first-time user. It is expected to be released in a starter pack consiting of the machine, cassette unit, *Introduction to Basic*, and four recreational programs.

The price for this package is very good value at £139.99.

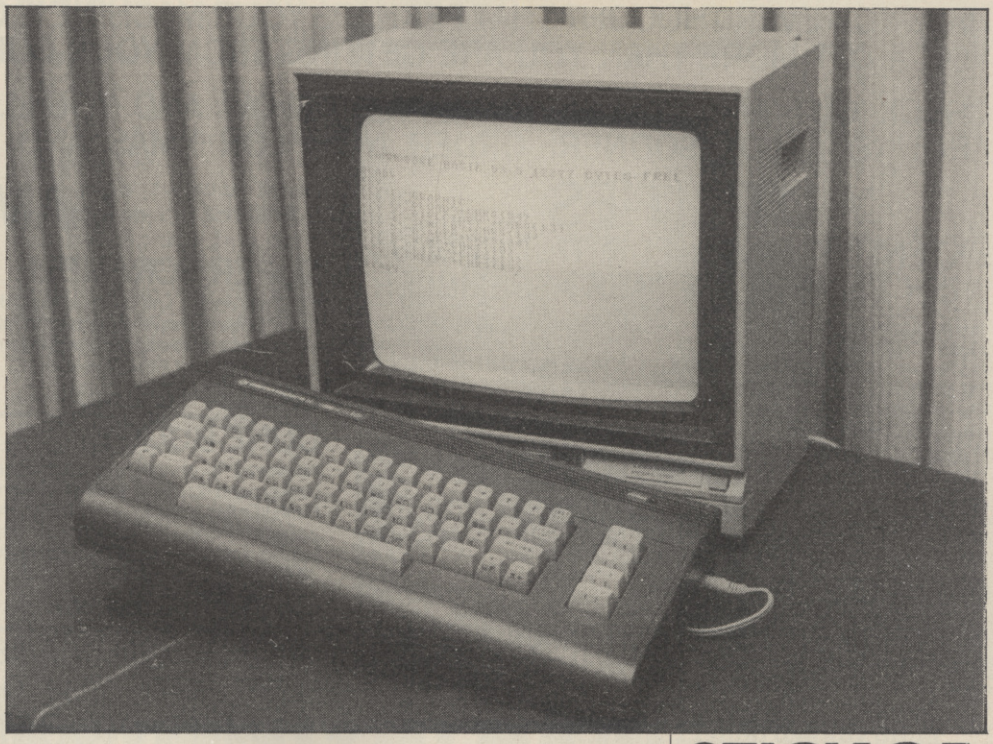
The Commodore 16 has a full-size keyboard, not unlike the Commodore 64, although the layout of keys is not quite the same. The Commodore 16 has a standard memory of 16K of RAM (hence the name), of which 12K is available to Basic.

Like the Commodore 64, and unlike the Vic 20, the screen size is 40x25, giving a high-resolution of 320 x 200 pixels. It is also claimed to give 121 colours on the screen, made up of 15 colours, at eight intensities, plus black. In addition, it has split screen capability.

The Basic in the Commodore 16 is much more sophisticated than anything Commodore has given us before. It is designated version 3.5 (which is odd, since it is claimed to be superior to both, versions 2.0 and 4.) The Commodore 16 is fully equipped with graphic capabilities, thus removing the need for the user to be proficient in hundreds of POKEs.

The microprocessor in the Commodore 16 is different from that in the Commodore 64, and in the Vic 20, thus rendering all the software incompatible. In addition, it is not possible to read a Commodore 64 tape on to the Commodore 16.

Since the current software for the Commodore 64 and the Vic 20 will need rewriting for the Commodore 16 and its big brother, the Plus 4, we believe that the Vic 20 has some life left yet particularly since it has sold so well.



EXTRA OUTLETS

The audio/video DIN connector on my Commodore 64 has three more outlets than are specified in the Commodore 64 handbook. Are these connections for an RGB monitor?

If so, what are the connection specifications?

Gurch Sounial, Birmingham.

The extra connections are of no significance and are probably the result of the manufacturers having run out of 5-pin DIN sockets at some stage, and so replacing them with pin compatible 8-pin sockets. The spare pins are unconnected.

ROM REPLACED?

Where can you send to for a replacement ROM — mine has developed the following fault: when the machine code routine at FFFO is called (kernal ROM), the cursor only moves to the desired line number, and not to the column position. It stays in column one.

When the routine is used to define the cursor position, register X is found to contain a value, but Y contains 0.

I have tried changing the 6502 chip, but to no avail. I do not want the expense of sending my Vic away, when I can insert the required ROM myself.

C J Cattanach, Herts.

The question here — which is not completely clear from your letter — is whether this fault in your ROM has suddenly appeared or whether you noticed it when attempting a machine code program.

The routine which you are attempting to use is, of course, part of the kernal ROM and is thus used extensively by the operating system. We would have thought that other operations would not work either.

If other strange effects have occurred, then it would look as though the ROM could be at fault. In this case you have several possible options.

You could try to find a friendly dealer who can supply and fit the ROM. Alternatively, ring Commodore and try to persuade them to send you a ROM replacement.

STICK OF THE DUMP

I recently purchased an Epson RX80/FT printer and a Stack Centronics interface. The copy command in Simon's Basic which is supposed to dump hi-res graphics to the printer doesn't work!

Michael Cheng, Scotland.

You don't say exactly how the high-resolution dump routine fails. For example, does the printer output garbage, the right symbols with too much spacing between lines, or nothing at all?

Does the computer hang up when the copy routine is invoked? Without this kind of information, it is difficult to make an intelligent guess as to the fault.

The Grappler CD interface from the American company, Orange Micro Inc, is the most general purpose interface we know of, providing a complete emulation of the Commodore 1525 printer as well as high-resolution dumps. You can configure it for most popular printers, including the Epson range.

Orange Micro do not have a UK address, but they do advertise in the British magazines, so presumably UK dealers can supply the interface.

GREAT NEWS FOR COMMODORE 64 OWNERS

HAVE YOU EVER THOUGHT THAT PERHAPS YOUR MACHINE IS CAPABLE OF GIVING YOU A LOT MORE THAN YOU ARE GETTING FROM YOUR CURRENT SOFTWARE?

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This excellent programmers aid includes a 60 page reference manual explaining in detail the **51** extra maultifunctional commands AND 10 CONTROL FUNCTIONS made available to you which include:— **GRAPHIC, SOUND, PROCEDURE, RENUMBER, PROGRAM LINE DELETION, DISK DRIVE ACCESS, SCREEN DUMP ONTO 1525 PRINTER & FUNCTION KEY DEFINING.** Although this program is 16K long it is located in such a way as to leave 35.5K available for storing a BASIC program.

CASSETTE £19.50 (DISK £21.50)

2/4 PASS MACHINE CODE ASSEMBLER

An undated version of the assembler contained in the Extended BASIC above. Comes complete with manual.

CASSETTE £5.50

"EPSON MAGIC" CENTRONICS INTERFACE

This program is a must for every owner of EPSON printers with dot addressable graphics (MX-80 upwards) with these great features:— PRINTS COMMODORE CHARACTER SET: PRINTS USER DEFINED CHARACTER SET: HIGH & LOW RES SCREEN DUMPS: BASIC WORKS WITH ANY CENTRONICS PRINTER: CABLE IS COMPATIBLE WITH AUDIOGENICS OR SUPERSOFT: CAN BE LOADED WITH OUR EXTENDED BASIC

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ONE METRE CABLE	£15.50
TOGETHER	£19.50

GAMES

SUPER SCRAMBLE

A great deal of effort went into the writing of this game, resulting in imaginative sprite and graphic design and beautifully smooth scrolling action. Not being satisfied with creating a superb version of this ever popular arcade game, the writer has gone on to add some extra features. Suitable for JOYSTICK or keyboard.

CASSETTE £6.50

DUNE BUGGY

Advanced programming techniques give you amazingly realistic background scrolling, the writer having split the screen no fewer than 7 times! Other techniques including multi-testing have been used in this game where you must race your buggy over the desert with the local customs militia determined to prevent your getaway. Fast action using JOYSTICK or keyboard.

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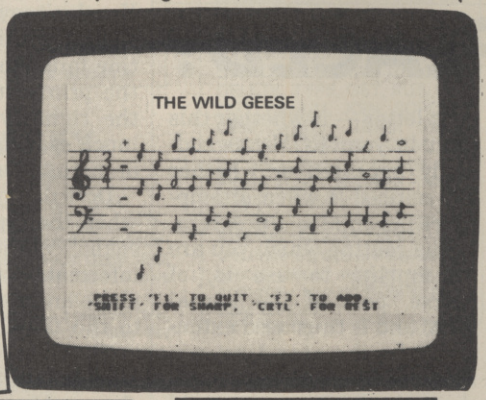

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FASTER LOADING

Could you tell me if there is any simple way to speed up loading and saving to tape on the Commodore 64? If not, can you recommend a program to this, and where to obtain it?

Also, is there any way to scroll the screen upwards for use in, say, a car race game?

Stephen Pegram, Kent.

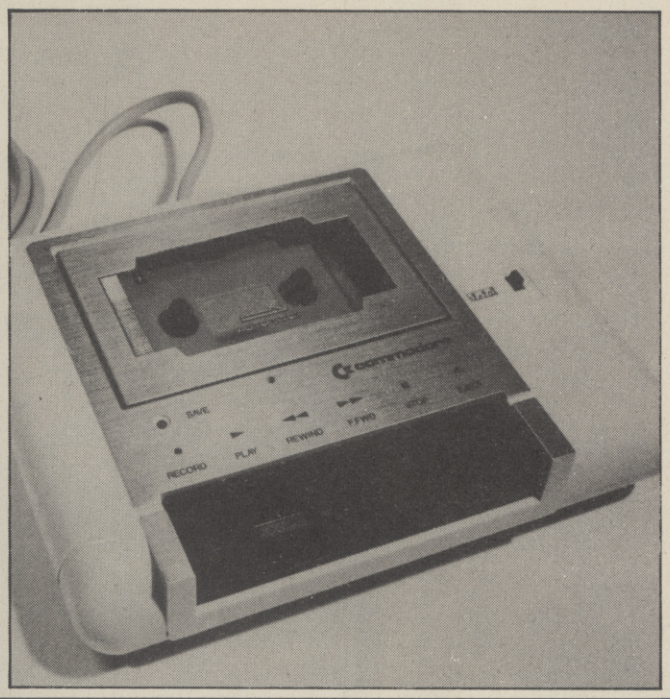
There are now several programs on the market which will speed up LOADing and SAVEing of programs on the Commodore 64. Many claim even to beat the speed of a 1541 disk drive – not the fastest thing on the market.

Anyway, you'll find a full feature on fast-loaders on page 25 of this issue.

These packages vary in price considerably from £7.00 to over £40.00. Two of the cheaper packages are the Arrow Turbo-Saver from Arrow Micro Services, priced £7.00, and Tornado from BSF CSL, priced £9.95.

In reply to your second question on the scrolling of the screen, this is quite a complicated procedure, but it is quite easy once you know what to do. In this respect we suggest that you study the *Programmer's Reference Guide*, pages 128-130, where it is explained quite well, with examples.

Arrow,
20 Portmeadow Walk,
London SE2.
BSF CSL,
82 Furnace Drive,
Crawley,
W Sussex RH10 6JE.



CREATE 'N' SAVE

How do I SAVE a character set that I have re-designed in a home-made program? I know it has something to do with addresses, but I do not know how.

Graeme Baxter, Edinburgh.

A character set is simply data stored in memory (either RAM or ROM) which represents the design of the various characters. Since it is just data, then the task of saving the set to tape or disk is carried out in exactly the same way as you would save a program. Since the start address is not at the start of Basic (2048), then the normal Basic SAVE will not be very useful.

In order to carry out the SAVE, therefore, you need to either use a monitor such as the Commodore Assembler Development package (£24.95, on disk) or, alternatively, you can write a small machine code routine which will save any portion of RAM.

Writing such a machine code program is very simple since the kernal ROM in your machine contains all the routines you need. You simply provide the parameters for the start and end addresses for your save (see page 104 of the *Programmer's Reference Guide*).

RAISING ALARM

I would like to use my Commodore 64 as a security device. How could I use the user port to sense for one or more voltages and act upon these, under program control?

M Healey, Basingstoke.

The user port is at 56577 (decimal) and you can PEEK it to read data from it, or POKE to it to output information. Since each bit of this byte can be seen either as input or output data, it's necessary to identify which of these possibilities is actually occurring. This is done with the data direction register which is at 56579. If a bit of this register is set 1, then the corresponding bit of the user port is assumed to be in output mode.

These bits appear on the port on the lower side of the socket from the third to tenth pin inclusive. (The third pin is the least significant bit). Pins 1 and 12 are both ground. It's pretty simple, then, to do things such as testing for an open window by using a microswitch to alter a voltage level between 0 and 5. However, you should ensure that the port is isolated from the outside world (half a hex inverter, or an opto-isolator will do) so that you do not risk blowing up the computer with external test circuitry.

A/D converters are readily available from such suppliers as RS Components and Maplin, although for your application, stepper motors which are directly, and digitally driven might be better.

A new product is the Sentinel burglar-alarm system from Micro-Security. The complete kit (priced £99), contains a relay interface and cable, alarm bell, contact switches and pressure mat, and the appropriate menu-driven software.

Micro-Security,
PO Box 18, Herts.

QUICK DRIVE?

As you know, the 1541 disk drive is really slow: could you please suggest an alternative disk drive system, and what extras are needed to run it on the 64? Also, would my existing software run on this system?

P P Gasson, Leicester.

I am thinking of buying a disk drive for my Commodore 64, and because the Commodore disk drive is slow, I wondered if I could use any other make of disk drive?

Andrew Wood, Essex.

One of the simplest solutions to your problem, though expensive, is to buy the Commodore 4040 twin disk-drive unit. This is connected to your Commodore 64 with a IEEE interface. (There are various makes of these on the market, at about £50 to £90.) The 4040 disk drive is about five times faster.

The 1541 is so slow because it uses a serial bus rather than a parallel interface, such as the IEEE. The way to speed up the 1541 is to increase the data transfer rate.

One product on the market which increases the speed of the 1541 by a factor of between two and three is the *1541 Express* produced by RAM Electronics. This costs about £50.

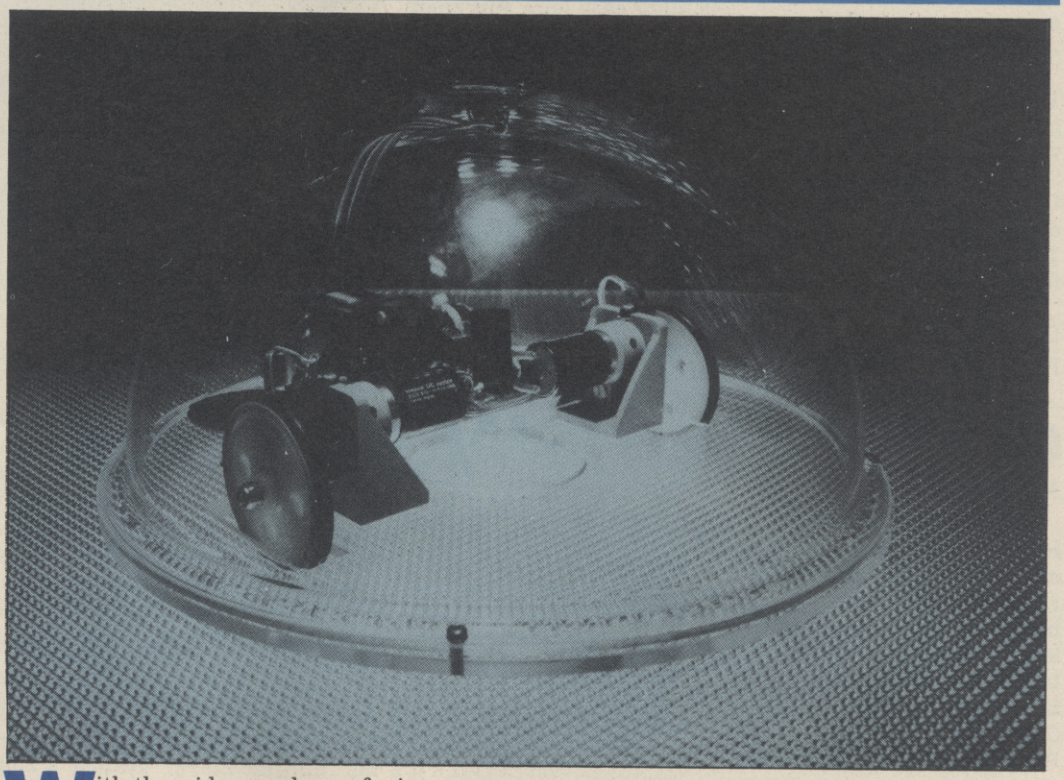
Because *1541 Express* fits in the cartridge socket, you cannot use any cartridge software while it is used. It does work with *EasyScript*, but due to its mode of operation, some packages may not work, so you should check with RAM Electronics if you consider this solution.

The 4040 drive should work with most packages although some interfaces can cause problems with protected disks. The format of the 4040 disks is completely compatible with the 1541.

EDUCATION

LEARNING WITH LOGO

THE LOGO LANGUAGE USED IN CONJUNCTION WITH TURTLES PROVIDED AN EFFECTIVE INTRODUCTION TO MICROS FOR THE YOUNG.



With the widespread use of microcomputers in schools and other educational areas, the Logo language has been riding high; and coupled with electronic turtles, it scores very highly indeed.

In this article we'll be looking at the Commodore Logo package itself, then go on to review two turtles that can be used in conjunction with it — the Valiant and Jessop models.

Although designed as a teaching language, Logo has many powerful features in its own right, enabling the creation of sophisticated programs. Its appearance on the 64 is doubly welcome, since it also provides language support for all the hardware features (unlike the primitive Basic 2.0 supplied with the machine).

For home use, Logo by itself is the only item that can really be cost justified. In the classroom, however, the addition of a turtle should prove invaluable. Although Commodore Logo does require a 1541 disk drive, at £34.95, it is fairly reasonable.

Commodore Logo comes with a hefty, 400-plus pages, A5-format handbook. The first disk is protected against copying and contains the Logo system software. The second, a utilities disk, is crammed full of useful procedures and attractive demonstration programs. This disk can and should be backed-up immediately.

The manual, entitled *The Commodore 64 Logo Tutorial*, reveals that this is the version due to Terrapin Inc, and therefore very much of a mainstream development. The book is just about OK as a tutorial — worthy, though a little dull. A beginner to the language would be wise to start with one of the more lively introductions to the language now available.

The manual describes, in turn, graphics, computation, list processing, sprites, and music, as provided by the system. It has a huge appendix covering errors, editing, projects, and the utilities disk. At the end is a section corresponding to a *Programmer's Reference Guide*, giving memory maps, and so on.

The actual implementation of the language on the 64 is very nice indeed. It has obviously been thought out carefully, resulting in a system that is a pleasure to use. An example of this is the pre-programmed function keys, where in turn F1, F3, and F5 select the text screen, split text / graphics, and the full graphics screen. Another nice feature is the inclusion of a 6502 assembler and a description of the built in 'hooks' of Logo, allowing users to interface machine language routines. In short, the Logo package allows you to do all you wanted to with Basic 2.0, without the tedium.

How then does Logo compare to Basic 2.0 in terms of speed and accuracy? Taking the latter point first, it appears that Logo does not have the known arithmetic errors of Basic 2.0, suggesting that it uses its own arithmetic routines. This is

borne out to some extent by the benchmark results which show that, in some cases, Logo is actually slightly faster than Basic although Basic does not translate exactly into Logo, or *vice versa*, it is possible to write functionally equivalent routines. The results of running these as benchmarks are shown in *Fig. 1* (see page 83).

In summary *Fig. 1* shows that Logo is about half the speed of Basic 2.0 — not at all bad when you consider the extra complexity needed in the interpreter. Certainly, the speed is perfectly adequate for most home and teaching purposes (it is only about 20 per cent slower than the Sinclair Spectrum Basic, for example).

For a user familiar with Basic 2.0, the most eye-opening features of Logo will be the graphics, use of recursive procedures, and list processing. The weak point of the language is undoubtedly the lack of control structures; it really only has three — REPEAT, IF and GO.

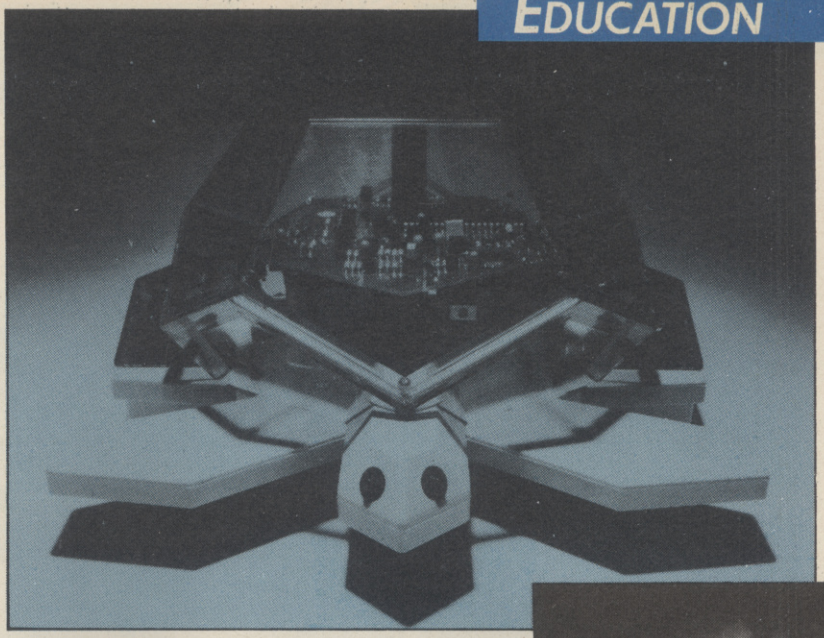
The most important feature of Logo to a young or novice user is the famous turtle graphics. This is recognised by the authors of the manual who place this topic before the chapter on arithmetic.

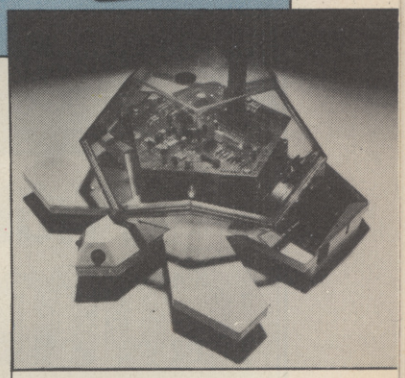
The Valiant turtle boasts a physical appearance not unlike a real turtle, plus remote control via an infra-red link, together with on-board rechargable batteries. The Jessop machine has the more traditional appearance of an inverted goldfish bowl with an umbilical cord. It does, however, have an in-built speaker, and remote control via radio is promised soon (there are even hints of vision, speech and range finding sensors).

The Valiant is currently priced at £228.85 (£171.35 to schools), while the Jessop is on special offer at the moment at £182.27. So both are probably rather too pricey for most home users. Some good news for schools is that Commodore offer a special package which includes the 64, a 1541 disk drive, Simon's Basic, and Logo for £295.

Both machines are provided with interface connectors for the 64 user port. In the case of the Valiant, this goes to the infra-red transmitter, while for the Jessop, a lead goes direct to the turtle itself. Both interfaces are supplied with a separate power supply (the Valiant unit doubling as a recharger for the turtle). The start up sequences for both machines is reasonably similar. First, Logo is started in the normal way and then a couple of files are read in from the disk provided to define the turtle control interface. A comparative assessment of turtle biology is given in *Fig. 2*. There were no significant differences in accuracy noticed when both turtles were tested on the same sized patterns, both were delivered correctly adjusted. Both machines needed hard, flat surfaces to run on — even minor ripples in the drawing paper sometimes caused problems.

We can now go on to discuss the pros and cons of each machine. The Valiant with its glowing eyes (battery condition monitor), interesting shape, and lack of visible connection to the computer, should prove an instant hit with children. The machine is of a fairly robust construction, and should be well able to survive the rigours of the classroom. We do have a criticism of the model provided for review, in that the shell (consisting of glued together transparent green plastic pentagons) had one or two sharp edges. This problem appears to be one of quality control, which should be tightened up for a product intended for use by children.





The Valiant turtle (above) is controled via an infra-red transmitter, where, as the Jessop model (far left) is connected by an umbilical lead.

The infra-red transmitter is provided with a relatively short lead. Experimentation showed that it was remarkably difficult to block the signal (little short of putting a hand over the transmitter would actually stop the turtle), and the range seemed adequate for an average classroom.

Apart from the shell, the only major criticism of this machine was the lack of a 'handshake' in the control system: without feedback, deviations in the turtle course due to imperfections in the drawing surface, or loss of signal are not detected, and any errors would tend to accumulate. Even so, no problems were found.

The Valiant turtle comes with two slim, but well produced, books: a general *User Guide* and *Penup*, a sort of owner's magazine. Also provided are some typed notes specific to the Commodore 64 Logo — these are brief but adequate.

A nice feature of the implementation is that the resulting patched Logo uses the same commands for the physical turtle as the screen turtle, meaning that most existing programs should run with the floor turtle with little or no change. An additional command is provided to turn the floor turtle on and off as required, so that a procedure can be tested on screen if required. Although the basic step size is supposed to be adjustable, none of the provided documentation revealed how to do this. Since fractional steps can be used, this is not a problem for the sophisticated user, but is important for children.

The Jessop (or 'Edinburgh') turtle can claim to be a direct descendant of the original. In the basic form supplied for review, it consists of a perspex hemisphere screwed to a flat perspex plate. An umbilical cord connects to the top.

The problem with the symmetrical design is that it is not obvious which way the machine is facing. Certainly this machine looks far less like a toy than the other, and would therefore probably appeal more to the older pupil. The use of a special pen was annoying. Like the Valiant machine, this turtle should be able to withstand normal classroom wear and tear.

A novel feature of this model is a built-in speaker, which can be made to beep under program control.

The use of cable to control the turtle was rather unsatisfactory, as, with the usual ▶

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Weldon, Corby,
Northants NN17 1QX.
Tel: (0536) 205555.
Valiant Turtle (priced £228.85; or £171.85 to schools) is available from:
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sort of recursive patterns drawn, it very rapidly became tangled and needed human intervention to prevent jamming. Jessop should replace this method of control as soon as possible. On the other hand the two-way control was much admired and, although not obvious in our tests, it was felt that the Jessop machine should be fundamentally more accurate than the Valiant.

It was apparent from the supplied documentation that the conversion of the Jessop machine to the Commodore 64 Logo was very recent. The main document was an A4, typed booklet describing its use with 'OKLOGO'. It was necessary to read this thoroughly to find the relevant sections on setting up and adjustment.

As a concession to 64 owners, a separate typed sheet of A4 is provided describing how to set up Logo for the turtle and the commands provided. Unfortunately, the commands chosen (single letter abbreviations) are non-standard and so existing procedures would need to be rewritten.

As with the Valiant, no indications given as to how to change the default step and rotation units. The step size, in particular, seemed rather arbitary. We reckon that Jessop needs to improve their documentation with some urgency.

For educational purposes, while neither turtle is perfect, they could become a useful and important part of the teaching process. For younger children, the Valiant scores heavily on appearance, and the potential slight inaccuracy due to the control method would be less important. For the older pupil, the Jessop machine, with its more technocratic appearance, should be more attractive.

By Conrad Nowikow, a computer consultant.

FIG.1

BENCHMARK TIMINGS, IN SECONDS, FOR 1,000 ITERATIONS.

Benchmark Number(BM):	Function:	Logo:	Basic:
1	Simple repeat loop	1.3	1.4
2	BM1 with counting	10.0	10.5
3	BM2 with arithmetic	44.3	19.2
4	BM3 but using constants	46.8	20.0
5	BM4 with embedded "CALL	51.3	21.0
6	BM5 with array set up and nested loop	68.0	32.2
7	BM6 with array access	213.2	51.6
8	BM1 with arithmetic trig functions average	116.2 68.9	116.0 34.0

FIG.2

PHYSICAL CHARACTERISTICS OF THE TURTLES.

	Valiant:	Jessop:
Diameter	30cm (max)	30cm
Height	14 cm	15 cm
Wheelbase	20 cm	23 cm
Weight	0.9 kg	1.1 kg
Speed	4 cm/sec	7 cm/sec
Std. step size	1 cm	0.17 cm
Std. rotation unit	degrees	degrees
Control	infra-red	cable
Range	6m	4.5m
Feedback	no	yes
Sound	no	yes
Undriven support	ball bearing	skid
Drive method	stepper motor	DC motor with optical sensor
Pen	standard berol	special

The robust Jessop Turtle was made for the classroom at £175. Toys cost (and do) a bit less!

The principle of teaching very young children fundamental computing through a Jessop Turtle has long been recognised and this view is endorsed by research at Massachusetts Institute of Technology and at Edinburgh University: The Jessop Turtle is already used in hundreds of British primary schools.

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The Jessop Turtle has a whole range of uses:

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● In the secondary school, it can provide low-cost, efficient entry to robotics. Its optical encoders, which tell the computer how far the Turtle has travelled or whether the pen is raised or ready to trace its path, are similar to those used in industrial robots.

● Secondary school students will turn the machine code program, used to control the Turtle, into the basis for a series of experiments and exercises in machine code programming and robotics.

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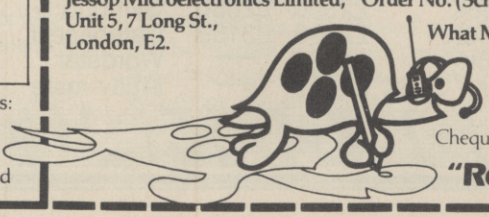

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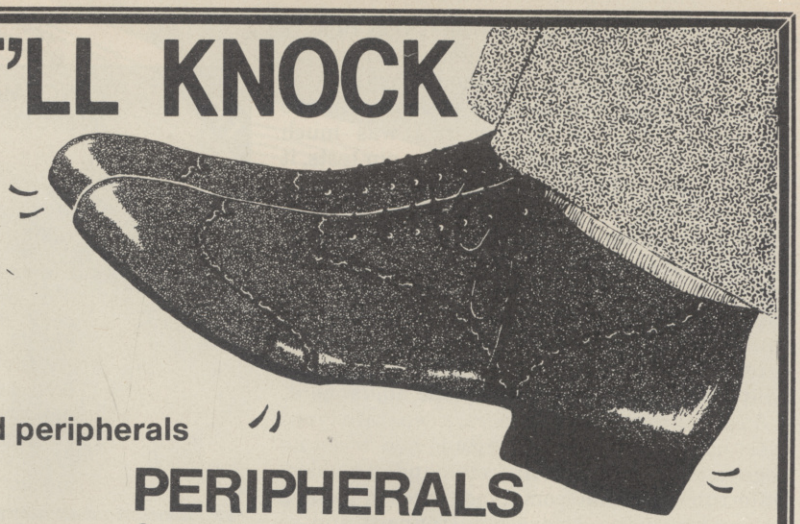

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Educational adventure programs are by no means a new idea, but *Macbeth*, based upon Shakespeare's masterpiece, is something quite different. Although not intended to be primarily a 'play-and-learn' affair, it does present an interesting slant on the learning process for literature students.

The *Macbeth* adventure pack contains four adventures and four 'psycho-analysis' programs on two tapes. Also included is a 20-page manual, and an easy-read version of the play.

In the first of the four adventures, you play the part of Macbeth himself as he takes on Scotland's enemies, before finally finding and translating an 11th Century runic-scripted letter. As this package contains both text and graphics, you'll have to use both if you want to complete the scenario.

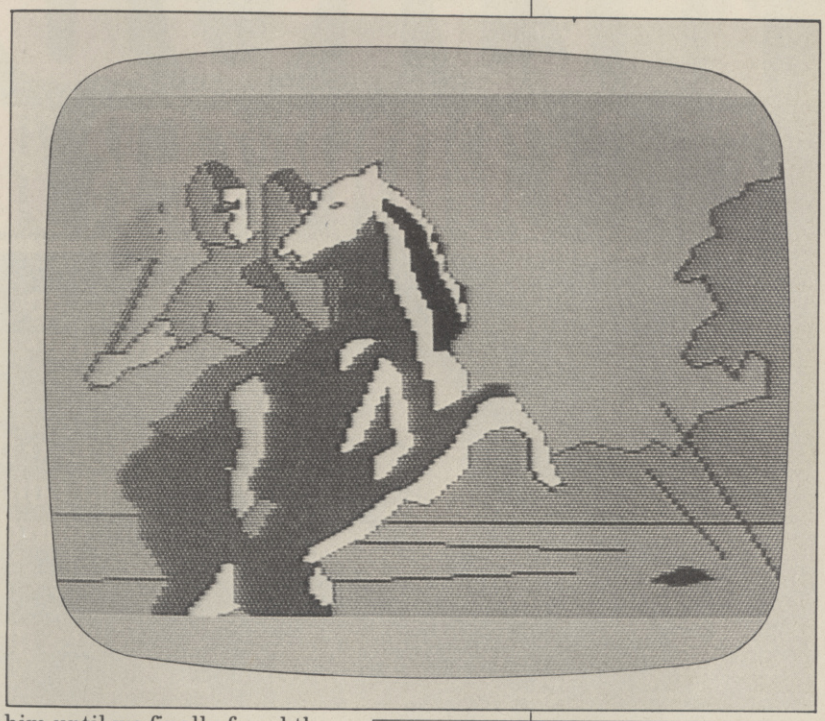
Having completed this stage, you become Lady Macbeth in what is probably the most difficult of the four parts, having to rush around Cawdor castle, collecting the necessary items for the king's arrival and banquet. If you persuade him to stay the night, you must make sleeping arrangements, encourage Macbeth to commit the dastardly murder, then arrange that you escape detection — and all this with a 60-minute time limit!

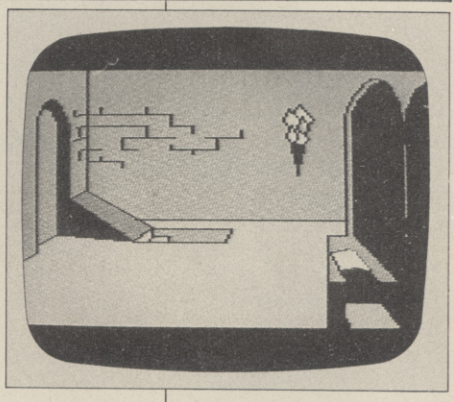
The third adventure has you collecting 10 vital ingredients for the witches' cauldron. This part is almost entirely graphical, and the clues are included within the pictures, so you have to keep your eyes peeled. In the fourth and final adventure, you rejoin the persona of Macbeth during the final siege. You must try to find ways of halting the attack whilst searching for secret rooms, finding the Shakespeare Master (whatever that is), and trying to withstand the challenge of MacDuff.

All the adventures are well-programmed with excellent graphics and many thoughtful touches. For example, when you perform some action which should alter your surroundings, the on-screen picture often changes slightly to represent this. The use of sound has been restricted to the occasional creaking door, croaking frog (padock), and suchlike — nevertheless, it is quite unusual to find any sound in adventure programs.

The English parser (the bit that works out what you've typed) is quite complex, though we did find that simply rewording a phrase, or even altering the order of the words, was often necessary. In response to your input, it highlights the first word in the sentence which it doesn't understand in a particular context — much better than the dreaded 'I do not understand' message. Help messages when trying to perform legal, but stupid actions were also very helpful.

The easy-to-read copy of *Macbeth* is an essential feature of the game. For example, when we came across our first major adversary (the rebel MacDonwald), it seemed impossible to get past him until we finally found the correct word to use in the play itself. The use of the text to complete the adventure is further emphasised by the abundant help messages which refer to sections of the original, sometimes cryptically. The script included with the package also contains a section containing notes about the real Macbeth and various aspects of the play.





Educationally-minded users will probably be most interested in the four psycho-analysis programs which are included — in each of these programs, you take on the role of a character within the play, to be analysed by the Royal Psychiatrist. The 'conversation' is more of a multi-branching question / answer session, including a lot of multiple-choice questioning. However, these programs are still educationally useful, encouraging people to not only read the play, but also to understand the motives of the characters.

For example, at the end of the adventure, the psychiatrist asks you as Macbeth whether you think you have made the most of your life, and what mistakes you might have made.

However, the educational uses of this package will be limited to some extent by the difficulty of the adventures. Hardened adventurers, however, will enjoy the challenges of these excellent and original adventures, which give the immediate impression of a quality product.

By Marcus Jeffery, technical writer.

Above: Gallowglass (a warrior) bearing down on you armed with an axe. Below: in the castle, dare you descend through the new open trapdoor?

Macbeth (priced £14.95) is available from:
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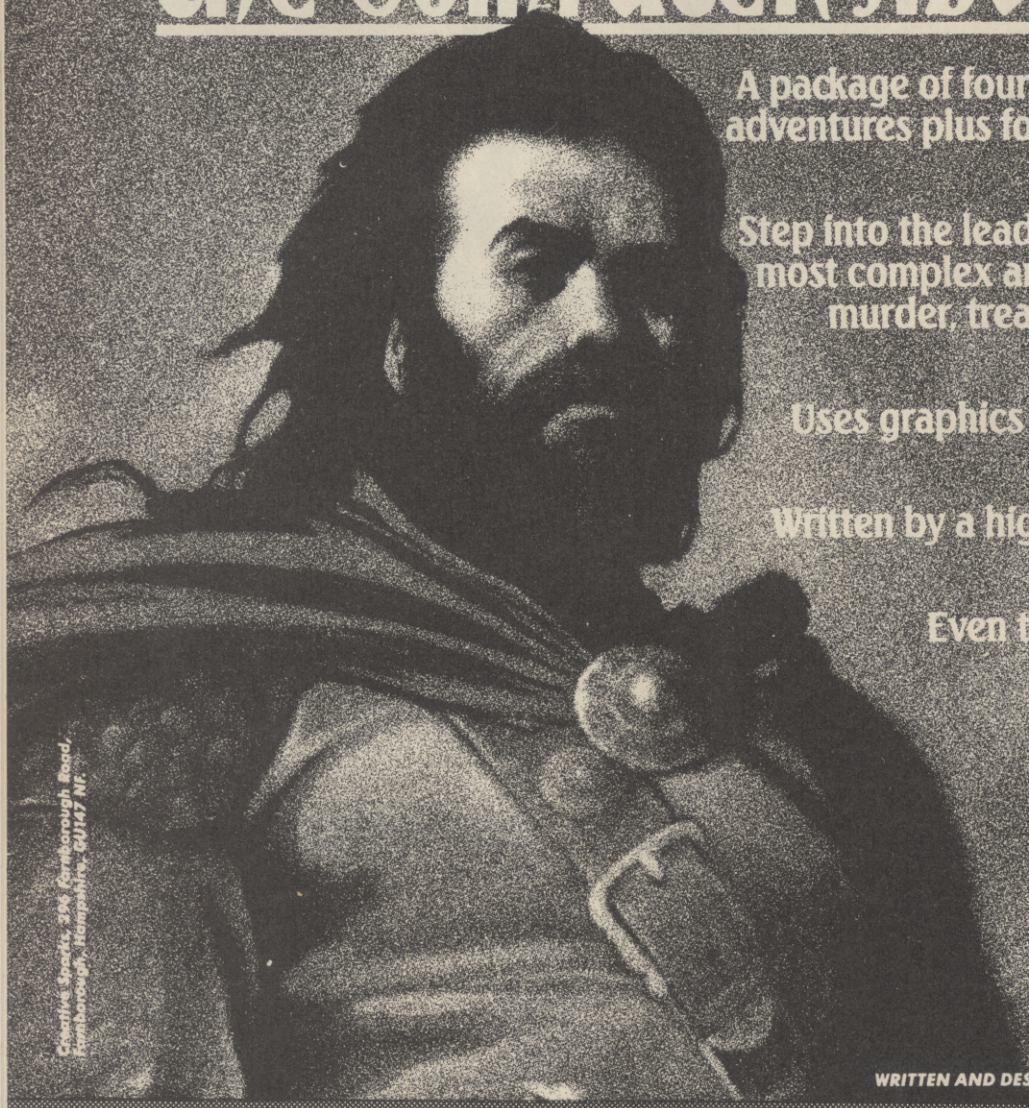

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PROFESSIONAL

DELVE INTO DATABASES

A DATABASE MANAGEMENT SYSTEM IS VITAL TO TURN YOUR 64 INTO A WORTHWHILE BUSINESS MACHINE.

One software tool any professional CBM 64 user should have in their library is a database management system (or DBMS). It may be used to keep track of anything from company records on customers to the details of the company wine cellars.

The first thing to note is that no professional is going to be willing to use a DBMS which is tape based — it is essential to use a disk drive in order to gain fast access to large amounts of data, the second thing is that there is a huge variety of packages on the market which all claim to provide the same service — that is a database management system.

We have looked at three such systems: *Superbase 64* from Precision Software (priced £100), *Simply File* from Simple Software (priced £60), and *Database* from Gemini Marketing (priced £25). All packages come on disk with user manuals although the Gemini database is also supplied on cassette (priced £20).

One fact which struck us immediately was that the length of the user manuals is proportional to the price. *Superbase* weighed in at a massive 200 pages (A5), *Simply File* at 69 (A4) and *Database* at a mere 20 (A5).

Superbase 64 comes on protected disk, so the backup copy provided is a thoughtful addition. Loading the program takes about two minutes on a 1541 drive.

First, the user is shown how to create a working disk for the database which is subsequently used for all the tutorial lessons, called, appropriately enough, Training. Setting up a database could not be easier, as it is performed using the powerful screen editor of the CBM 64. The various unique fieldnames are typed on the screen as required; this screen is subsequently used for all database operations on single records.

The next stage after defining the names of the fields is to define their type. Possibilities here are: Key used to identify the record rapidly for key searches; Text (up to 255 characters); Numeric 3 (9 digits); Date (1 Jan 1980 — 31 Dec 1999); Calender; Constant; and Result.

The *Superbase* program is set up to be used via two main menus, or directly by typing the command. In command mode, more than one command may be entered at once — particularly useful as the user becomes more experienced.

Records may be found again via the Select option on the first menu, once in, it is possible to select records in a wide variety of ways: they may be browsed by using the Next and Previous keys, or a particular record may be found by using the key field. This method of access is very fast finding records anywhere on the database file within about three seconds. Alternatively, the Match option may be used if a sequential search is required. It does have the advantage of being able to match on any one or combination of fields within a record.

One good feature is the help screen. These screens may be selected from one of the menus, and give information on all the common commands. It is possible for the user to create his own by using the memo feature.

One very common application of a database is to keep mailing lists (hence the vast number of circulars we all receive these days). *Superbase* includes a program all ready set up on the disk which will allow the user to format labels as required. This brings us to a very important point, as *Superbase* will work with other printers other than Commodore's. There is a command called PDEF which sets up the code to be sent whether CBM ASCII or true ASCII, there is then another command, PDEV, which will cope with RS232, IEEE or Centronics interfaces. Even more useful is a start up program, START.P, called automatically on initialising *Superbase*

It is possible to modify the defaults in start p to set up your printer on initial loading of the program. We used an Aztec Centronics cable with a Mannesmann Tally 132 column printer, and this was found to work first time.

The other very important feature provided on *Superbase* is the Report writer. This enables you to write your own report using the powerful extra 40 commands provided by the *Superbase* programming language; it is, however, easier to use the Report writer for simple reports as it prompts for items like headings, subtotals, selection procedures to be used and writes the program for the user. This program may then be saved to disk and edited, if necessary.

As alluded to above, *Superbase* provides the advanced user for whom the menus, label and report writer are not enough, a sophisticated programming language which provides an extra 40 database commands in addition to the Basic ones. There is space in memory for 4K of user programs, although the manual mentions possible chaining of really big ones. Most applications are unlikely to take more than 10-20 lines.

The programming language allows automatic linking of files within the database (*Superbase* allows a database to consist of 15 files). Linking is very important for the automatic updating of record within one file with data from another. This is once again illustrated by example on the TRAINING database in the user manual. Other useful commands provided are the ASK command for user prompting, PLEN to set the page length and PROTECT to prevent a file being listed.

Superbase is a very comprehensive database management system, fast and easy to use (being written in machine code) the manual giving plenty of examples and reference information. It is possible to import and export data to and from *Superbase* via sequential files. At £100, *Super-*

base gives good value for money, no problems were found.

Simply File is supplied on a single disk. Interestingly enough, the manual states that they have taken the decision not to protect the program so a backup is possible (and indeed very desirable before starting to use it). The data is stored in random files on a 1541 disk and consequently does not appear in the disk directory — a severe problem, as it means that it is vital never to validate the disk (validate releases the allocated blocks and so effectively would delete all databases on the disk).

Also, since the database files do not appear in the directory, it is necessary to do a byte-by-byte copy of the disk, which on a 1541 using the Commodore utility is extremely tedious taking 20-30 minutes!

Simply File is written in Basic with machine code subroutines where speed is important.

The manual is well written, but we would have preferred the manual to apply to the CBM 64 only, rather than needing to filter out Pet information.

As with *Superbase* the manual takes the user through a series of tutorials. This is carried out with the aid of three databases ont he disk called MAIL, STOCK and PURCHASES. In addition, the user is guided through the setting up of a new file TEST. Setting up a new file is fairly straightforward, although we did not like the method adopted of prompting for each field name in turn.

After using the *Superbase* direct screen entry method, *Simply File* seemed a little primitive. One other feature which was that only the total size of the record needed specifying and not the invididual size of each field, which allows a high degree of flexibility when filling in fields. The other feature which was very useful was the ability to create more than one indexed key field per record. For example, in a mailing list it is possible to set up an index for both surnames and company names.

Once a database has been set up, the means of accessing the records is much the same as *Superbase*. There are Next and Previous commands, along with Delete and Find options. In addition, there are Add and Change options.

There is a labels program provided on the distribution disk. This works in a very similar manner to *Superbase*. No problems were found in producing labels, the speed of their production was about the same as *Superbase*.

Simply File, while having some disadvantages (resulting from the bulk of it being written in Basic), does nevertheless constitute a worthwhile DBMS. If only the addition of records and other fundamental operations were carried out using data screen (entry rather than prompting) it would be very good value at £60. However, as the program stands it appears to be well written. We did manage to crash the system once, but otherwise no problems were found.

The Gemini program was the third one looked at.

Setting up a database is very straightforward, being carried out using the CBM screen editor. In fact this was simpler and more user-friendly than the *Simply File* method, so full marks to Gemini here. Once again the basic functions for rcord management are provided; namely BROWSE, ADD, AMEND, DELETE and FIND. In these respects, Gemini compared well with the other two systems. In addition, a good feature is the display of the estimated number of records left until memory would be full.

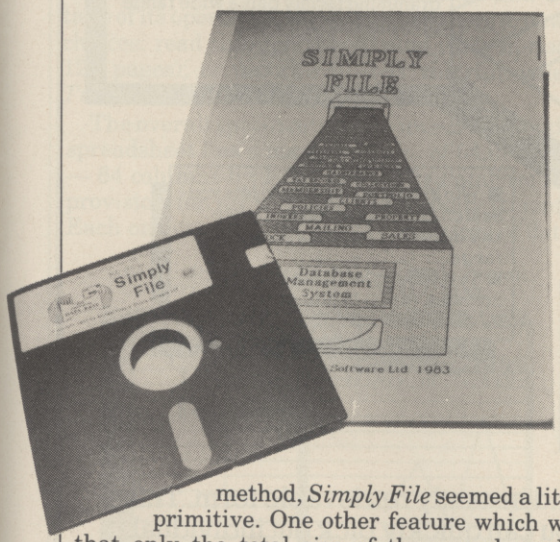
Unfortunately it was not possible to reproduce the printouts given in the manual except on the screen. The Centronics software interface in our possession succeeded in confusing the Gemini package so comprehensively that Gemini wouldn't even give the initial menu! The manual does contain a section on printer customization. One phrase which is particularly helpful is 'The printer you are using needs a software interface constantly in memory which is not relocatable — *this problem cannot be solved*' (our italics).

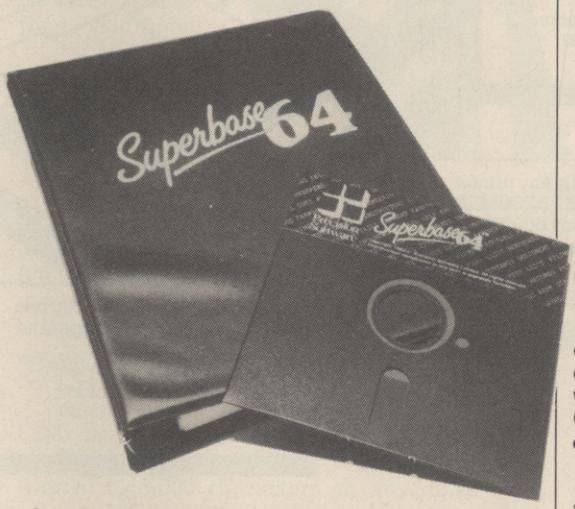
The manual does indicate that there is a spare 500 bytes of memory at 37079 to 37579 set aside for printer interface software. We feel the failure of Gemini to provide such software within the program is rather a poor omission, as a database system without use of a printer is somewhat useless.

In conclusion, Gemini is fairly cheap at £25. It does give the facilities expected of a DBMS, but we feel anyone using the system for long would soon get frustrated when the memory filled up. If the user has a Commodore printer, then the system is capable, in principle at least, of producing report type output; it is, however, more suited to the user without a disk drive. Any user with such a drive would naturally want to be able to take advantage of the extra storage capacity provided by a disk-based system. It is suggested that unless your requirements are fairly modest, you should look elsewhere for your database rather than to Gemini.

When choosing between *Superbase, Simply File* and *Database*, it is, as always, a matter of cutting your coat to suit your cloth.

By Andrew Tindell, a senior computer consultant.





Far left: Simple Software's 'Simply File', is, as it's name suggests a simple DBMS. Left: 'Superbase 64' is for the advanced user who requires a number of diverse facilities. Above: Gemini's Database — cheap but useful.

Superbase 64 (priced £100) is available from:
Precision Software,
6 Park Terrace,
Worcester Park,
Surrey KT4 7JZ.
Tel: (01) 330 7166.

Simply File (priced £60) is available from:
Simple Software,
15 Havelock Road,
Brighton, Sussex
BN1 6GL.
Tel: (0273) 504879.

Database (priced £25) is available from:
Gemini Marketing,
18a Littleham Road,
Exmouth,
Devon EX8 2QG.
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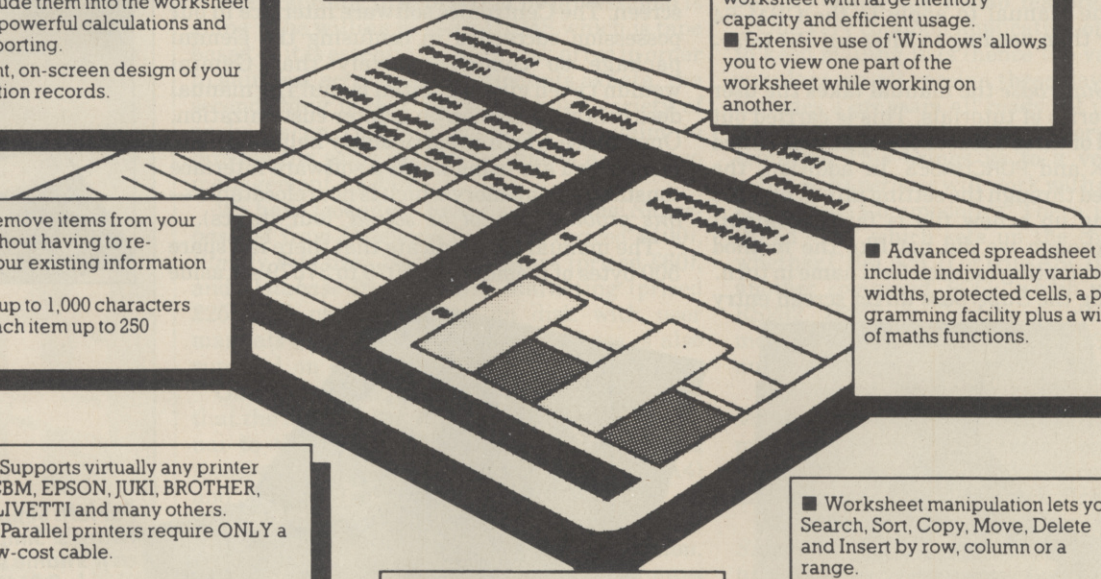

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IMPRESSIVE INTEGRATION

'VIZASTAR' OFFERS 64 USERS INTEGRATION ON A SINGLE DISK?

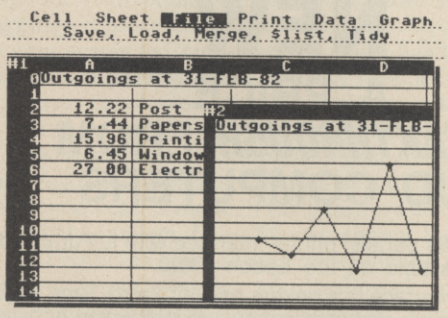
The Commodore 64 has established itself as a all-round machine, and an increasing number of serious programs have been developed for it; but hitherto there has been nothing to the standards of such advanced integrated programs as *Lotus 1-2-3* — not, that is, until now.

The newcomer is *Vizastar* from Viza Software, which is the company who have already produced software for the Commodore 64 in the shape of *Vizawrite*, and *Vizaspell*, a word-processing and spelling program, respectively.

Vizastar has three applications: a database, a spreadsheet, and a graphics facility. Originally, the program was to be supplied all on a single disk; however, the threat of piracy problems persuaded Viza's Kelvin Lacy that some form of effective protection was essential. This is why the package is supplied as one disk and a plug-in cartridge.

Any new program presents a problem in understanding the various commands and details of its operation. With *Vizastar* there are two choices: read through the manual (it comprises 120 pages); or use the on disk tutorial called *Tutor*.

The overall specification of *Vizastar* is that the spreadsheet has a maximum size of 64,000 cells — 64 columns by 1,000 rows. The database has provision for up to 1,200 filing compartments. Each one can hold up to 124 characters of data.



The graphics facility allows a choice of either line or bar graphs.

The version tested has an extra 4K memory in the cartridge, while another version, *XLB*, will have provision for colour bar and pie charts.

Vizastar normally would be used with the Commodore 1541 disk drive; however, it can also be used with the Commodore IEEE/parallel drives using an extra interface and the Interpod. *Vizastar* will also support the Centronics parallel interface, and RS-232 fitting printers can be used, with an additional interface.

When you first load the program, a worksheet display appears complete with a 'cell' pointer showing the first cell on the sheet. The main menu is called up by pressing the CMB key (with the logo). Once this has been done the main menu line appears at the top of the screen.

The main menu line has six options: CELL, SHEET, FILE, PRINT, DATA and GRAPH. Each of them have their own sub-options, taking you further into the detail of the program.

You then select the appropriate option just by lining up the cursor against the appropriate word; Pressing RETURN brings up the sub-menu.

The first version of *Viza star* was available shortly after the Commodore Show at Novotel. Since then, additional features have been added as a result of users comments. The version we examined was revision A20 with A2, the report option can now handle 10,000 records when used with large Commodore disk drives, and with 8-9,000 records, access times on practical test averaged just three seconds.

When the spreadsheet option is used the text assignment, formula =B2 will now show numbers as well as text.

Vizastar configures itself to operate on any CBM disk drive with file sizes being limited only by disk capacity. However, record sizes are limited to 8,000 characters on any drive.

Lacey has also tidied up some of the operations to make them easier for the first-time user, and more important an additional graphics facility has been added.

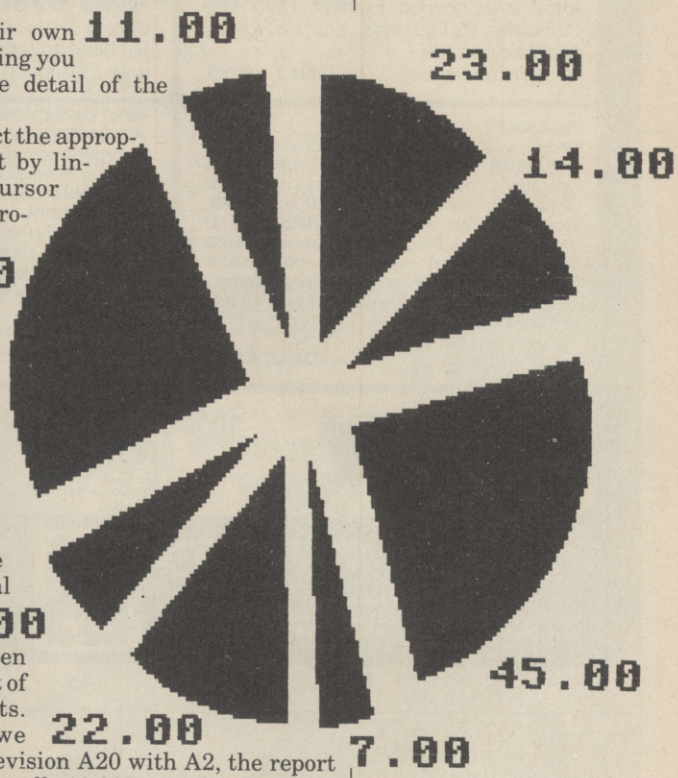
Although there is a graphics facility with the normal version of, Viza Software have launched an extended graphics package — *XGP* which offers two more options — multibar and pie.

These provide full-screen colour pie charts and three-dimensional scrolling bar graphs. Although these options do appear on the standard version, if you try to use them on the existing disk the message 'File not found' appears.

Existing users can buy the extended graphics package for £14.95 including VAT. The extended graphics package is supplied with the extended memory version of *Vizastar XLB* and will cost £129.95 (inc. VAT). Existing users of the normal version *XL4*, can upgrade for the difference in cost between the *XLB* and *XL4* programs.

All they have to do is return their *XL4* cartridges with a cheque for £30. Standard *Vizastar XL4* is available at £99.95 (inc. VAT).

By Neville Ash, a freelance writer.



Exploding pies (above) and data graphs (left) from Vizastar.

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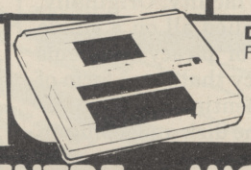

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C64 ON-LINE

COMPUNET IS A TELEPHONE-ACCESSABLE DATABASE ESPECIALLY FOR COMMODORE OWNERS.

When bulletin boards and telephone-accessible databases first became all the rage, Commodore 64 owners were feeling somewhat left out in the cold. However a new service, Compunet, aimed solely at 64 owners has remedied the situation with one bold stroke. First impressions were good. It is resident on a national network belonging to ADP, so around 65 per cent of the population can acess it for the cost of a local call.

Compunet is also a multi-user system, unlike bulletin boards which allow only one caller at a time. The software allows colour graphics to be used — another great boon.

The modem which allows the user to interface with Compunet in itself represents exceptionally good value. It is a direct connect modem, (rather than the less efficient acoustic coupling type) and is a 1200/75 baud unit. In addition to being used for Compunet, it will also work with Prestel/Micronet, and give 1200/1200 half duplex operation for direct user to user calls.

The software for accessing Prestel with this modem is already available and the user-to-user software is promised for the near future. As well as being approved for use on standard BT lines, the modem has built-in auto-dial facilities.

To cap it all, included in the £99.99 asking price is a year's free subscription to Compunet, worth £30 itself.

However, as the euphoria of using a new system began to wear off, a sneaking feeling arose that everything had been designed for the supplier's convenience not the actual user's. The logging-on procedure is a case in point. In order to gain access to Compunet, the caller has to input both a password and identity number. Not only does this have to be absolutely correct, but it has to be correct for that particular modem.

The reason is that Compunet's host computer interrogates the modem for its serial number each time a call is made. If the password does not match the modem, then the user cannot log on.

All this poses several drawbacks for the user. First, automatic log-ins are disallowed, so the information has to be keyed in each go. You also have to be careful to use your own modem not a colleague's. Nobody can guess how long it will take Compunet to register new users either.

Another gripe is over the system's error checking which operates the whole time, not just for specific sections. The reason for the error checking is purportedly for ensuring that no corruption sneaks in to spoil the caller's enjoyment. However, we still managed to get a corrupted electronic message.

Far worse is the system's habit of throwing off callers without warning if it decides that the line is so noisy that too much corruption is occurring. We would regard this as extremely unfriendly considering (yes, you guessed it) the user has to go through all the process of logging on again. What happens when the lines to Compunet start getting busy as per Prestel?

Naturally, all of Compunet's tight security has its pay-offs. Inside the modem is an electronic dongle. If the user downloads software from Compunet, the program will only run when the modem (and hence the dongle) is attached. Not only does this ensure that the software is paid for, but it prevents copying.

Try to run the disk or cassette without the modem and the program begins to corrupt itself. Commodore is so sure that this will defeat the pirates that it has allowed one of its most successful programs, *Soccer*, to be on offer.

Good news too is that an interactive adventure game known as *MUD (Multi-User Dungeons)* will be available on Compunet as the result of a deal with Century Publications. Rather like the board game, *Dungeons and Dragons*, it has attracted a fanatical following on Essex University's computer. The cost will be an additional £5 per month and £3 per hour.

One of Compunet's biggest claims to user friendliness are its carousel or 'duckshoot' menus. These are a set of commands which scroll across the screen to the left or the right. In order to select a command all the user has to do is use the arrow key on the Commodore keyboard and wait until the desired command is centralised. Pressing RETURN initialises the command.

It is early days for Compunet, and several sections are still in their infancy. One of these is Courier, Compunet's electronic mail service. Electronic banking will also be a feature along with electronic shopping courtesy of COMP-U-CARD. One enterprising company has already taken advantage of Compunet to offer a service to business users: National Property Link allows estate agents nationwide to swap information, match clients to properties, properties to clients, or just show what premises are on the books.

A great deal of Compunet's success depends on how well the system is accepted. It remains to be seen if the local Compunet telephone numbers (nodes) become oversubscribed. One cannot predict how much of the truly popular Commodore 64 software will find its way onto the system.

By Tony Dennis, deputy editor.

USEFUL ADDRESSES:

Compunet Teleservices,
Metford House,
15-18 Clipstone Street,
London W1P 7DF.
Tel: (01) 637 0942.

National Property Link,
Water Eaton,
Swindon,
Wilts SN6 6JU.
Tel: (028481) 521.

Century Publishing
12-13 Greek Street,
London W1V 5LE.
Tel: (01) 434 4241.

Compunet modem (priced £99.99) available from:

Commodore UK,
1 Hunters Way,
Weldon, Corby,
Northants. NN17 1QX.
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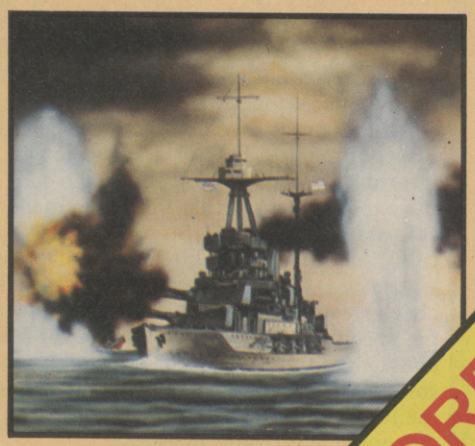

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The excellent reviews and enthusiastic retail reception given to Logic 3's basic tutorials—'Learn BASIC' have been proved justified as over 22,000 of the existing tutorials (for the Sinclair Spectrum and Dragon microcomputer) have been sold to date.

"Learn BASIC" comprises a 192 page workbook laid out in classic step-by-step text book fashion without the failing, common to so many computer books, of trying to get the pupil to run before he has learned to walk. What is *different* about the method is the way in which the computer itself is used to complement the printed material. At the end of each chapter the pupil is asked to load a quiz program into the computer. If the results of the test indicate that all the previous material has been understood then the pupil is asked to proceed to the next chapter. If the pupil has not grasped a particular topic then the quiz program asks the pupil to read again the appropriate section in the previous chapter. As well as the test programs the two tapes which are included with the workbook also contain many sample programs based on the material covered in each chapter.

Logic 3 have just released versions of the tutorial for the BBC Microcomputer and Acorn Electron, and a version for the Commodore 64 is to be launched shortly.

Logic 3's "Learn BASIC Programming" tutorials have been widely accepted as the most easy-to-use, educationally sound introduction to computer programming for beginners.

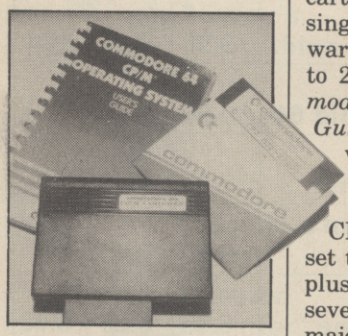
CP/M SHORTCUT FALLS SHORT

WHAT HAS CP/M LOST IN TRANSITION TO THE 64?

CP/M is an attractive option to any Commodore 64 users who want to get their machine functioning in a business capacity, and Commodore's own CP/M-Z80A package, for £50, seems like a very good deal compared to the £399 outlay BBC owners would have to make; well, it is and it isn't.

For a start off, you do *not* get a second concurrent processor *a la* BBC Z80. Since CP/M is a disk operating system (DOS), then it is no surprise that at minimum you must have a 1541 disk drive as a prerequisite.

So what do you get for your money? An alternative box/folder contains a large black CP/M cartridge containing the Z80A processor, a single disk holding the CP/M 2.2 system software and an A5 spiral bound handbook running to 240 pages. The handbook is entitled *Commodore 64 CP/M Operating System — User Guide,* ominously the first page has the word 'PRELIMINARY' printed diagonally across the first page.



The Commodore CP/M system: cartridge, disk and documentation.

The manual, while not intended as a CP/M tutorial, gives sufficient information to set the system up and to discover what the 20 plus CP/M commands and utilities do. There are several minor errors in the manual, and three major ones. The first major error, and the most worrying initially, is the repeated reference to more than one distribution disk (on pages 11 and 20). The system is supplied with only one disk and that is all you need. The second and third major errors are ones of omission, namely pages 173 to 184, and a promised circuit diagram are missing! While annoying, neither of these is vital to using the system; the missing chunk of pages consists of assembler listings of some CP/M utilities. All preliminary versions of the manual seen by us have the same fault.

Providing you have a reasonable standard configuration the installation could not be easier. The CP/M module is simply inserted into the cartridge port, taking the usual precaution of powering down before making any changes. The cartridge can be left installed even when not running CP/M, as unlike a normal games type cartridge it does not autoboot. Other than plugging the cartridge in, no changes are needed to the system. Unfortunately, the CP/M cartridge does not replicate the port.

Having installed the cartridge, the CP/M distribution disk is inserted into the drive and an 'native' file run to boot CP/M. The manual goes on to describe clearly how to make a working copy of the CP/M disk, and how to configure the system for the available memory (48K on a 1541-based system). It does not mention that the write enable slot of the distribution disk should be covered before you start, to avoid any accidents likely with an unfamiliar system.

Unhappily, getting the system working was not as simple as it should have been. The first cartridge supplied was a complete dud, showing no sign of working at all (it rattled). The second cartridge obtained responded as described in the manual, but on entering CP/M started acting on the screen. Discussion with the supplier revealed that the CP/M cartridge is known not to work with some otherwise apparently normal 64s, in fact it was necessary to hunt through half a dozen brand new 64s to find one that would work with CP/M.

The reason for this is that Commodore have changed the kernal (the machine operating routines) at times, with the result that there are three possible 'versions' of kernal you might have. To ascertain which, try typing in PRINT PEEK (65408): if you get the reply 0, then CP/M should work; if you get 3, then CP/M will *probably* work; if you get ?, then CP/M will probably *not* work.

If the latter is the case, you should be able to get the 64 replaced under warrenty (assuming that the supplier can find one that works).

Having got your CP/M system up and running, what does it give you and what can you do with it? Firstly, when CP/M is running the 6510 in the 64 and the Z80 add-on processor are alternatively active. The Z80 runs the CP/M operating system, its utilities and applications, and because all the necessary device drivers are already resident in the 64 operating system, all input and output is handled by the 6510. At the CP/M user level there is no need to be aware of this, though the manual gives sufficient detail.

The user can add to or modify the system as required, possible because the whole operating system is held in RAM. Certainly this implementation of CP/M is sufficiently complete for the user to discover all the ins and outs of using CP/M. This includes the fact that the standard editor (ED) supplied with the system is a pain to use, and that the standard assembler (ASM) only understands 8080 op — codes (so learning to use the Z80 will be rather fraught). The usual solution is to obtain a full Z80 assembler and decent text editor, which brings us to the major flaw in the system.

Although CP/M provides a standard operating environment, it does not mean that the disks are of a standard format. The only CP/M software we know of that has been translated into this format is Nevada Cobol, Nevada Fortran and Microsoft Basic — not a particularly impressive catalogue!

Even supposing the format problem is solved, there still remains the problem of the 64's 40 column screen.

Commodore's CP/M 2.2 package is an interesting product for those technically-minded who want to experiment with CP/M and the Z80; however, we reckon that until Commodore or someone else can solve the screen layout and disk format problems, it will not be of much use to those wishing to use CP/M for serious work.

By Conrad Nowikow, a computer consultant.

Commodore CP/M package, (priced £50) available from:
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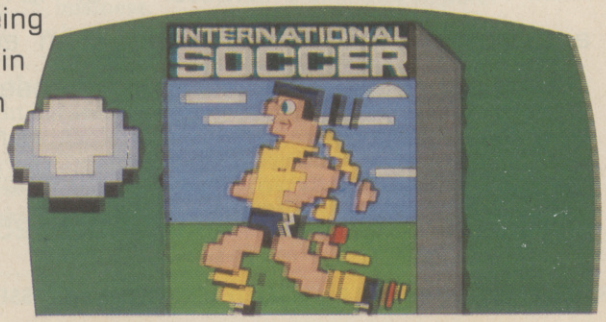

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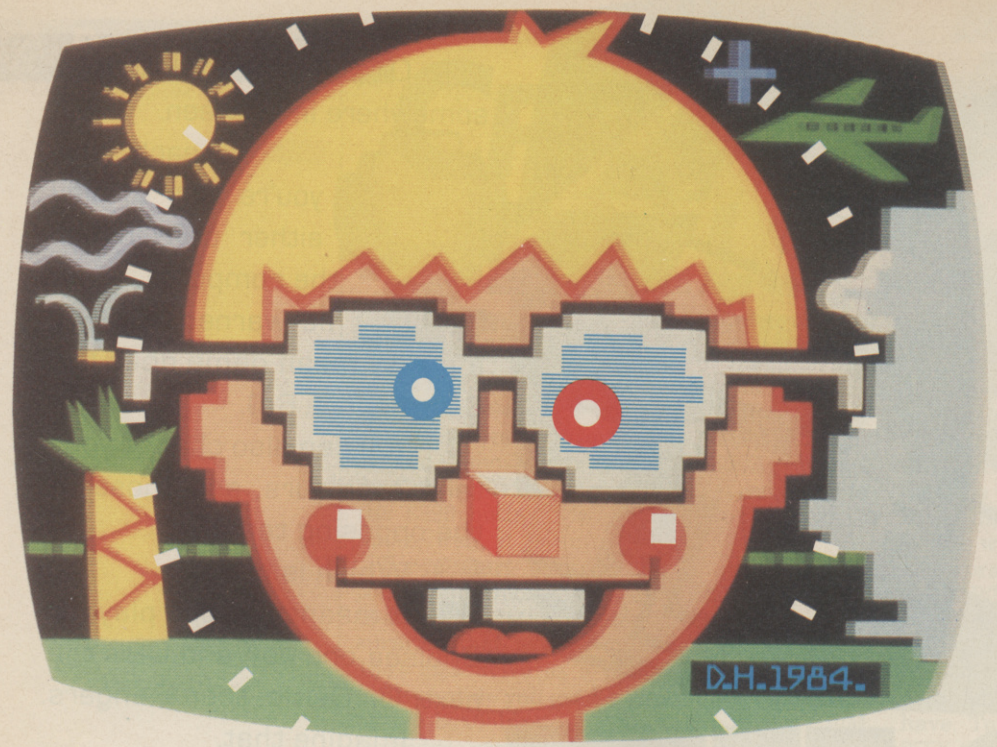

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LIQUID LOSSES

This issue's Legal File is based around a cautionary tale from Mr William Walker of Chigwell in Essex, who had an unfortunate experience with his Commodore Vic 20.

A couple of years ago, Mr Walker bought a Vic from Rabbit Software — a company which at the time he supposed to be a dependable retailer. After some months of satisfactory use, he purchased a 16K memory expansion unit from the same supplier. Unfortunately, the memory unit developed a fault and stopped working properly. Its replacement proved to be even worse — it failed to work at all.

Acting upon the advice of the Commodore Customer Information Centre, Mr Walker returned the 16K unit and the Vic20 to Rabbit in the hope that they could find out what the fault was and do any necessary repair work under guarantee; and that was the last time Mr Walker saw either his Vic 20 or his 16K memory unit.

After 12 months of remonstrating with Rabbit and after making various pleas for help to Commodore, he decided to sue Rabbit in the local County Court. Not only did he sue, but he also won his case and had judgment awarded in his favour.

Unfortunately, Rabbit still refused to settle, and by the time Mr Walker had arranged for the bailiffs to be sent in, Rabbit had gone out of business and all their assets, including Mr Walker's computer, had been disposed of by their liquidators.

Mr Walker is now reconciled to the loss of his system, and the money he spent on legal proceedings, but he does think that other readers of *Commodore Answers* should be aware of the risks of having something repaired by a dealer, rather than demanding a refund or a replacement. We couldn't agree more.

In law, if you buy something which subsequently turns out to be faulty, the supplier who sold it to you is said to be 'in breach of contract'. There is, however, the legal concept of 'acceptance of goods', — which we do not need to go into in this article — and to preserve your rights, you must complain immediately. Tell

the supplier in no uncertain terms that the goods are 'unacceptable' and if you get no response, put your complaint in writing.

Do this, and you are entitled to one of two remedies — either damages, that is to say, cash compensation for the cost of getting the thing repaired by an outsider, or a full and immediate refund of the purchase price.

In practice, because most customers are more interested in having the thing work than getting their money back, they will be prepared to accept an offer from the supplier to either replace the item with a similar unit, or repair it free of charge. The point to remember about such an offer, however, is that you are under no legal obligation to accept it. If you want your money back, then you must have your money back. Whether the supplier offers a replacement, a repair, or even a credit note, is irrelevant.

Admittedly, a replacement or a repair is probably perfectly acceptable in 99 cases out of every 100 — but, as Mr Walker discovered to his cost, there is always a slight risk. The risk is that, once you return an item to a supplier for repair, you may never see it again.

Sometimes this is due simply to the supplier's incompetence, but there are other reasons. In the microcomputer market, there is an unfortunate tendency for suppliers to go out of business.

It is not that Rabbit's creditors would deliberately have deprived Mr Walker of his Vic20. What is most likely to have happened is that they seized every bit of computer equipment left lying around Rabbit's former premises, and sold the whole lot off as the assets of the business in an attempt to recover some of the money they were owed.

Of course, Mr Walker could contact Rabbit's liquidators and make his claim for money to the value of the missing Vic20 and memory unit. Unfortunately, he is unlikely to recover anything, because of the way business debts are dealt with in this country. 'Preferential' creditors, such as the taxman are entitled to be paid first, and in full, while 'unsecured' creditors (which includes anyone else with a legal claim against the company, such as Mr Walker) have to make do with a proportional share of what, if anything, is then left over.

Usually there is very little left, while the unsecured debts are massive — the result being that creditors owed perhaps tens of thousands of pounds only recover a few hundred pounds.

So, Mr Walker can try contacting the liquidators to see if there is any likelihood of him recovering anything, but we're afraid we don't hold out much hope for him.

As to advice to other people facing similar problems, we can only suggest that if they are considering sending something new back for repair, don't — unless the repairer will loan you similar equipment to tide you over. And whatever you do — do it quickly. The longer you delay taking any necessary legal action, the weaker your legal rights become.

Mr Walker should really have moved rather faster, since Rabbit could then still have been in business.

Lastly, what about Commodore, you ask? Well, although their role in this affair might not seem to have been very creditable, it was, from a strictly legal point of view, correct — although we doubt if that is of much consolation.

LEGAL FILE

WHAT CAN YOU DO IF THE COMPANY REPAIRING YOUR MICRO GOES BUST?

Charles Christian (left) is a qualified barrister and a computer writer, who will using his knowledge of Britain's impenetrable legal system to answer your complaints and queries in a comprehensive way. If you want access to the Legal File use the question card bound in with this issue, and mark the card 'Legal File'.

GETTING ONTO THE BOARDS

Entering the world of micro communications can appear daunting. In order to make things easier for Commodore users we have prepared a layman's guide to accessing bulleting boards. *Commodore Answers* has its own board — CABB — but the information given here will stand you in good stead with all the systems used in the UK.

To access any bulletin board, first connect your micro to the modem via the RS232 interface. We could recommend the interfaces from Stack and Impex. Now load the communications software (see *Term 64* overleaf).

Check that the default values in the communications software are correct for the board you intend to call. Baud rates are given in our guide (see *Fig. 1*) and virtually all boards are full duplex (that is information flows both ways simultaneously).

The protocols needed for bulletin boards will be 1 start bit, 8 data bits, 1 stop bit, no parity or 1 start bit, 7 data bits, 1 stop bit, even parity. Some bulletin boards can be accessed using Prestel Micronet software, and these are marked in our guide. However, in the majority of cases Prestel software and bulletin board's are incompatible.

Ensure the modem has been set to the correct baud rate and mode (that is, originate) then dial the number. When the bulletin board's modem has answered the call, it may be necessary to throw a switch on your modem to begin communications.

In the case of acoustic couplers, ensure the mouthpiece is inserted the correct way around.

The most common cause of problems is the micro-to-modem cable. Check with the modem supplier if you suspect that the connections are incorrect. Some modems require one of the pins on the RS232 to be 'high' before they start communicating, and this may require cross connecting two pins in order to fool the modem into working.

Dial (01) 631 3076. When CABB's modem answers the call, you will hear a whistling sound. If all is well, the greetings text should appear.

When prompted, enter your first name and then carriage return <CR>.

Enter your last name (for speed, you can enter Fred; Bloggs; Anytown) <CR>.

After the system has checked the userlog (it takes a little while), it will ask for town / country if you are a new user.

The board will then display 'TBBS welcomes FRED BLOGGS, calling from ANYTOWN. Is this correct?'

Check this carefully. If anything is misspelt or corruption has occurred (normally in the form of little squiggles) answer N for no.

The reason for being so careful is that any personal message sent back to you will mirror the misspellings or other errors. If next time you log on with the correct data it will appear that you have no mail.

Take note of your own details, as it is fairly common for users to log on under a nickname, Dave for example, then wonder why the system does not recognise them as David.

Once satisfied that the details are correct, enter Y for yes. The system will then ask for a screen width. Commodore 64s are usually 40 characters, but 80 is another possible setting. Vic 20s are 22 characters. The user is then presented with a list of popular micros.

There are established settings for the Vic 20 <I> and Commodore 64 <M>. But this has been set up for communications software such as *Term 64* so if you have anything different hit <CR>. Then CABB will ask:

Can your terminal print line feeds?

How many nulls do you require?

The first two questions need little explanation, but should you ask for no line feeds and find that everything gets printed on the same line it will spell trouble. The solution is to input two 'S" and then press X followed by F. This should get you to <F>ormat.

The opportunity to reconfigure your system setting will be then presented and you

FIG. 1

Board name:	Tel. No:	System operator:	Hours:	Baud:
(TBBS systems:)				
Mailbox-80 Liverpool	(051) 428 8924	Peter Tootill	24hrs	300
TBBS London	(01) 348 9400	John Nolan	24hrs	300
Blandford Board	(0258) 54494	Leo Knaggs	24hrs	300
TBBS Southampton	(0703) 437200	Chris Cain	24hrs	300
CNOL	(0524) 60399	Mike Buckingham	12.00-10.00	300
PIP Sheffield	(0742) 667983	Quentin Reidford	24hrs	300
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Microweb	(061) 456 4157	Mike Bibby	24hrs	300
CABB	(01) 631 3076	Tony Dennis	24hrs	300 + 1200/75
Mailbox-83 West Mid	(0384) 635336	Jim Roden	17.30-08.30	300
System CBB	(01) 606 4194	Dave Coles	24 hrs	300
CBBS (R) systems:)				
CBBS (R) South West	(0392) 53116	Boyd Hitchcock	24hrs	300 + 1200/75
CBBS (R) Surrey	(04862) 25174	Mike Parker	24hrs	300
CBBS (R) Chiltern	(07073) 28723	Ken Hirst	21.00-08.00	300
CBBS (R) MG-Net	(01)399 2136	Peter Goldman	17.00-22.00 Sun	300
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Comaco-Net Hull	(0482) 831215	unknown	unknown	300
(BBC orientated systems:)				
OBBS Manchester	(061) 427 1596	Robert O'Donnell	09.00-19.00	300
NBBS East	(0692) 630610	Jon Freeman	22.00-00.30	300
Beeboard London	(01) 624 7460	Squid Gilmour	unknown	300
Bloxam	(0295) 720812	Alec Crawford	18.00-20.00	300
(Atari orientated systems:)				
Southern BBS	(0243) 511077	Jonathan Sanders	24hrs	300
ABBS Worthing	(0903) 42013	David Harvey	21.30-08.00	300
NKABBS	(0795) 842324	Dave Frost	21.30-24.00	300
(Prestel compatible systems:)				
C-View	(0702) 546373	Rochford D.C	24hrs	1200/75
Hackney	(01)985 3322	Hackney B.C.	24hrs	1200/75
Aberdeen	(0224) 641585	Aberdeen ITeC	24hrs	1200/75
Communitel	(01) 968 7402	Bill Olivier	24hrs	1200/75
Estelle	(0279) 441188	STC Electronics	09.00-18.00	1200/75
(Commercial systems:)				
Estelle	(0279) 443511	STC Electronics	09.00-18.00	300
Maptel	(0702) 552941	Maplin	24hrs	300
Distel	(01) 679 1888	Display Elec	24hrs	300

can ask for line feeds. Should you still be confused you'll have to call back using a slightly different name!

Alternately, call up as LOST; PASSWORD and ask the Sysop to change your userlog entry not forgetting to give your real name.

The question asking how many nulls are required is really for users who have unbuffered printers attached to their micros or unusually slow terminals. In most cases, zero (0) nulls are required.

If you selected <M> for the Commodore, CABB then prints:

Upper/lower case
Line feeds needed
00 nulls required after each <CR>
Do you wish to modify this?

Unless you have unusual software, the answer is naturally N for no.

The system now asks for an eight character password. Insert your own password. Don't forget to take a note of it immediately as you won't be allowed on to the system under that name without it.

It is important to remember that the system will not accept lower case characters for your password if you originally used upper case and vice versa.

Each user has three attempts to get the password right before being thrown off.

At this point the caller should be well and truly logged on to the system.

CABB which is using popular bulletin board software called The Bread Board System (TBBS) will then give your caller number, and the number of the last message.

The next thing to appear will be a newsfile, followed by a new user guide. If possible capture these to a printer. Neither file will be repeated although you will see the news again when it is changed.

The new user guide can be read again if you go to <I>nfo and select option 5.

After these two files, the user is presented with the main CABB menu.

The majority of the main CABB menu is self explanatory. Should you <P>ause a file, then use a <CR> to restart it.

Please make sure you leave personal messages on the <E>lectronic mail (Email) board not the <O>pen board which everyone can read, as it gets very tedious deleting them.

Should you wish to have access to CABB's special Commodore Users board, then leave a request to the Sysop as you sign off. However, you must have installed a password or your priveleges won't be changed.

Callers initially have 15 minutes on the system, so speed is of essence.

It is not strictly necessary to sign off the board using <G>oodbye but we would recommend using <G>. It is feasible just to ring off as there is no charge.

CONNECT COMMODORE

To help budding Commodore hackers get in on the bulletin board scene, we've come up with a *Term64 (Fig. 3)*, a program which provides all the basic communications facilities needed for accessing CABB (our very own bulletin board) with a Commodore 64.

Term64 was written by Basil Stephens who intends to update it in the near future to include uploading and downloading facilities as well as a routine to allow the use of a printer.

In order to use *Term64* all you need (in addition to the basic Commodore 64) is an RS232C interface (for example Stack's); a 300 baud modem (like the DaCom Buzzbox), and a modem-to-micro cable.

Term64 is CBM Basic 2-based, and is designed specifically to run at 300 baud. Theoretically it would be possible to alter the settings and run at a faster baud rate, but you would probably find it necessary to wait for the Basic to catch up. To gain a little speed and cut down the amount of keying in, it is possible to omit all lines with REM statements.. Other lines can be amalgamated if desired but take care not to change the overall meaning of the line.

The communications protocols of *Term64* have been set to 1 start bit, 8 data bits, no parity, 1 stop bit. The only other commonly used protocol setting is 1 start bit, 7 data bits, even parity, 1 stop bit. To do this you need to alter line 1030 to read thus: 1030 Open 1,2,0,chr$ (38) + chr$ (96). Baud rate is set in the same line to 300 baud but for our purposes it will be unnecessary to change it.

A number of the functions keys have been designated to perform specific tasks. These are: F1: display the help file; F3: send automatic log-in; F5: display time since log-on; F7: Change screen colours.

This leaves four function keys available for the user to define as desired (to printer, and so on.)

Pressing the F1 will remind the user exactly how the function keys have been defined. F5 is a handy option which shows how long a call has taken so far, this tells you just how much money you are spending on the call, or how long you have left before the system automatically logs you off (CABB for instance only allows users 15 minutes on the system before it disconnects you.)

In order to take advantage of F3, it is necessary to input a log-in string at line 1050. For CABB, the log-in string has to be in the form "Fred-;Bloggs; Anywhere", but you can alter this to suit any other system providing you know what it expects in place of the ";" character in order to create a new line.

Function key 7 allows you to change all the screen colours to anything you desire. If you then press the F1 key, the border colour will change, press F3, and the background will change; and finally, F5 changes the colour of the printed characters. If you don't like the colour simply answer 'N' to the question "Colours OK?".

Each parameter has a choice of 15 different colours before you loop back to the beginning again. When you are satisfied with a particular colour just answer 'Y'. The really perverse can go for a totally unreadable screen by choosing the same colour for all three.

In theory, when you buy a modem the requisite cable comes with it; however, very often this is not the case. For

FIG.2

RS232 interface: Signal name:	Pin:		Modem interface: Signal name:	Buzzbox DIN pin:
TX	2	– – – – – – –	TX	1
RX	3	– – – – – – –	RX	4
RTS	4			
CTS	5			
DSR	6			
SG	7	– – – – – – –	SG	2
CD	8	– – – – – – –	CD	5
DTR	20			

FIG.3

```
100 REM ********************************
110 REM *CBM 64 BASIC TERMINAL PROGRAM *
120 REM * AUTHOR BASIL STEPHENS        *
130 REM * DATE OCT1984                 *
140 REM *OP 7-BIT FULL DUPX, DIM ARRAYS*
150 REM ********************************
1000 REM ******************************
1010 REM  * BASIC SET UP               *
1020 REM ******************************
1030 OPEN 1,2,0,CHR$(38)+CHR$(160)
1040 DIM I$(127),O$(255)
1050 LGIN$="FIRSTNAME;SURNAME;TOWN"+CHR$(13)
1060 CR$=CHR$(42)
1070 CRSR$=CR$
1080 GOSUB 8000
1990 REM ******************************
2000 REM  * PRINT HELP MENU            *
2010 REM ******************************
2020 PRINT CHR$(147)
2030 PRINT"USE FUNCTION KEYS"
2040 PRINT"   AS FOLLOWS"
2050 PRINT:PRINT
2060 PRINT"F1: THIS MENU
2070 PRINT
2080 PRINT
2090 PRINT
2100 PRINT"F3: SEND LOGIN MESSAGE
2110 PRINT
2120 PRINT
2130 PRINT
2140 PRINT"F5: TIME SINCE LOGON
2150 PRINT
2160 PRINT
2170 PRINT
2180 PRINT"F7: CHANGE SCREEN COLOURS
2190 PRINT
2200 PRINT
2210 PRINT
2220 PRINT "THE (CBM) KEY IS THE CONTROL KEY"
2990 REM ******************************
3000 REM  * RECEIVING AND SENDING LOOPS*
3010 REM ******************************
3020 PRINT CRSR$;CHR$(157);
3030 COUNT%=COUNT%+1
3040 IF COUNT%=10 AND CRSR$=CHR$(42)THEN CRSR$=CHR$(32):COUNT%=0
3050 IF COUNT%=10 AND CRSR$=CHR$(32)THEN CRSR$=CHR$(42):COUNT%=0
3060 GET CH$:IF CH$=""THEN 3100
3070 CCODE%=ASC(CH$)
3080 IF CCODE%>132 AND CCODE%<141 THEN 3140
3090 PRINT#1,O$(CCODE%);
3100 GET#1,ECHO$:IF ECHO$=""THEN 3020
3110 PRINT ERA$;I$(ASC(ECHO$));
3120 IF ECHO$=QUOTE$THEN POKE 212,0
3130 GOTO 3100
3140 ON CCODE%-132 GOTO 2020,6020,5020,7000
4990 REM ******************************
5000 REM  *  PRINT TIME SINCE LOGIN    *
4990 REM ******************************
5000 REM  *  PRINT TIME SINCE LOGIN    *
5010 REM ******************************
5020 PRINT"[CLEAR,DOWN5]     TIME SINCE LOGON IS;  "MID$(TI$,1,2)"
   :"MID$(TI$,3,2);
5030 PRINT":"MID$(TI$,5,2)"
5040 GOTO 3020
5990 REM ******************************
6000 REM   SEND LOGIN MESSAGE          *
6010 REM ******************************
6020 GET#1,CH$
6030 LET TI$="000000"
6040 FOR K=1 TO LEN(LGIN$)
6050 PRINT#1,O$(ASC(MID$(LGIN$,K,1)));
6060 NEXT
6070 GOTO 3100
6990 REM *********************************
7000 REM   CHANGE SCREEN COLOUR          *
7020 REM *********************************
7030 PRINT"[CLEAR,DOWN7]      F1: CHANGE BORDER COLOURS
7040 PRINT
7050 PRINT
7060 PRINT"      F3: CHANGE BACKGROUND COLOUR
7070 PRINT
7080 PRINT
7090 PRINT"      F5: CHANGE CHARACTER COLOUR
7100 PRINT
7110 PRINT
7120 GET A$:IF A$=""THEN 7120
7130 IF ASC(A$)<133 OR ASC(A$)>135 THEN 7120
7140 A=ASC(A$)-133
7150 IF A=2 THEN COL=PEEK(646):COL=COL+1:IF COL>15 THEN COL=0
7160 IF A=2 THEN POKE 646,COL:GOTO 7270
7250 COL=PEEK(53280+A)-240:COL=COL+1:IF COL>15 THEN COL=0
7260 POKE(53280+A),COL
7270 PRINT"   COLOURS OK?  (Y OR N)";
7280 GET B$:IF B$=""THEN 7280
7290 IF B$<>"Y"AND B$<>"Y"THEN 7000
7300 GOTO 2020
7990 REM *********************************
7990 REM ******************************
8000 REM *   DEF VARS AND CONV TABLE   *
8010 REM ******************************
8020 QUOTE$      = CHR$(34)
8030 ER$= " " + CHR$(157)
8040 DARK$       = CHR$(42)+BACKSPACE$
8050 TI$       = "000000"
8060 O$(13)=CHR$(13): I$(13)=CHR$(13)
8070 O$(20)=CHR$(08): I$(08)=CHR$(20)
8080 FOR K = 32 TO 64
8090 O$(K)= CHR$(K)
8100 I$(K)  = CHR$(K)
8110 NEXT
8120 FOR K =65 TO 90
8130 O$(K) = CHR$(K+32)
8140 I$(K)  = CHR$(K+128)
8150 O$(K+128)= CHR$(K)
8160 I$(K+32)  = CHR$(K)
8170 NEXT
8180 FOR K = 91 TO 95
8190 O$(K)= CHR$(K)
8200 I$(K)  = CHR$(K)
8210 NEXT
8220 O$(148)=CHR$(13)
8230 O$(160)=CHR$(32)
8240 O$(171)=CHR$(17): O$(174)=CHR$(19):O$(175)=CHR$(16)
8250 O$(188)=CHR$(03): O$(179)=CHR$(125):I$(125)=CHR$(179)
8260 I$(92)=CHR$(94): I$(95)=CHR$(164)
8270 PRINT CHR$(14)
8280 RETURN
```

such circumstances we have included a list of the pin connection so that you can make up a cable of your own. Although the RS232 standard calls for 25 pins, with modems the most you will actually need is five cores to the cable. All that you will need to do is to make four connections and loop back two sets of pins at the RS232 connector.

For simplicity's sake, we have used the common abbreviations: TX means transmit, RX receive, SG signal ground (earth), CD carrier detect, and so forth. Please note that the individual cores should be screened (isolated) when making up this sort of cable.

Please note that we have given the pin numbers for the Buzzbox which utilises a 5 pin DIN plug. If a standard 25 pin D type plug is used then the numbers would be identical, for example, pin 2 to pin 2, and so on.

So that the Commodore can send and understand ASCII control code, the CBM key has been configured to act as a control key. CBM key and the S key (control s) together will send an X-off, and CBM and Q key (control q) will send an Xon. This will provide the standard file transfer protocol of Xon/Xoff should you require it.

For the really keen there is already a public domain terminal program available on CABB, which includes the standard Christensen/Xmodem file transfer protocols. In order to use it, however, currently you have to capture it as a hex listing and key it in laboriously. Eventually we hope to have a simple routine that will allow users to download it using *Term64*.

By Tony Dennis, depty editor, and Basil Stephens, a communications engineer.

RS232 interface (priced £33 inc. VAT) from:
Stack Computers,
290-298 Derby Road,
Bootle,
Liverpool L20 8LN.
Tel: (051) 933 5511.
Bi-directional RS232 interface (priced £24.45 inc. VAT) available
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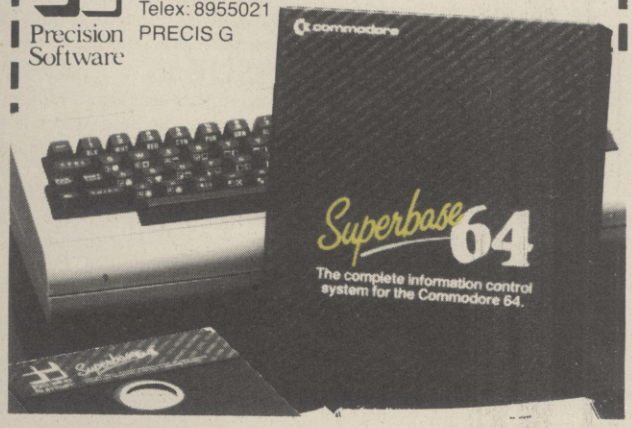

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BACK ISSUES

Computer Answers, the forerunner of Commodore Answers, was published as a general magazine for two years before expanding into machine-specific titles. Many of the articles, answers and reviews were relevant to the Commodore machines. Each issue costs £1.50 (inc. p&p) and is available from the Back Issues Dept. at our Frith Street address (see Contents page).

ISSUE 1 (Nov/Dec 1982):

If you want a copy of an article from this issue, please send 50p per article (see contents page for address) marking the envelope 'Copy service'. We will send you photo copies of the appropriate pages. Jupiter Ace, DEC Rainbow, Commodore 64 (reviews); ZX81 upgrade; 8/16 bit choice; Z80 cards; ASCII code; Program swapping; I/O concepts; Printer plug-in; Assembler course (introduction); Program generators; Basic queries; Graphics; Commmunications; Database management systems; The UCSD p-system; Multiuser systems; CP/M utilities; Bad-quality software.

ISSUE 2 (Jan/Feb 1983):

CP/M Plus (CP/M facelift); Memory (RAMs and ROMs explained); Baud explained; Configurations (WordStar on Epson); Program editors; Assembler course (part 1); List sorting program; Program concurrency; CP/M revealed; **Computer Answers File No 1:** Home Computing (domestic applications); Word-processing advice; Communications modems; Maintenance; Sales talk; Legal File (maintenance agreement small print).

ISSUE 3 (March/April 1983):

VisiOn and Lisa (reviews); Torch upgrading (the Tube); Changing print characters; Z80 workhouse; Assembler course (part 2); APL program language; CP/M utilities and corrupted disks.

Sinclair Clinic; Systems expertise; Beware of selling hype ('relational databases'); Business graphics (principals); Stargazing and biorhythmic software; Copyright clauses; Budget micros; Micro manufacturers answer back; Renting software; Legal File (piracy problems).

ISSUE 4 (May 1983):

Sage IV (review); Microfloppies; Data preservation; Apple IIe (review); Government's choice of micros; Monitors; Slide-show controlling; Digital input; Random numbers; Assembler (part 3); Professional games programmers.

Dragon and Texas Clinic; Making music on micros; Spreadsheets (Planner-Calc); Business graphics (practice); Toolkits; Ergonomics: Legal File (small claims procedure).

ISSUE 5 (June 1983):

Pinball Construction Set (review); VisiWord (review); Power (what constitutes a micro's muscles); IBM Clones; Buses; Data structures; WordStar Workshop (part 1); Number base conversion; Random numbers; Gw Basic; **BBC Clinic**; Business Operating System; Horserace Forecast Package (review); MasterCalc (review); Classroom computing; Games simulation; Software security; Setting up (selling your own software); Legal File (defaulting mail order advertisers).

ISSUE 6 (July 1983):

New Osborne Executive (review); Lotus 1-2-3 integrated software package (review); Plotters; Memory expansion; User-friendly software; 'Turtle' conversion job; Communications (file transference); **Commodore Clinic**; Lisp langauge; WordStar Workshop (part 2); CP/M supervisors; Computer aided design; Spreadsheets (MultiPlan); Micros in the music studio; Insurance; Computer holidays.

ISSUE 7 (August 1983):

System speed; Choosing a printer; Typewriter conversion; Preserving on Proms and Eproms; 'Turtle' conversion (Part 2); Assembler course (final part); Programmers Ten Commandments; WordStar Workshop (part 3); **Atari Clinic**;

Exploiting Operating Systems; Cassette-based word processing, spreadsheets, and databases (reviews); Computer Aided Learning (CAL); Pilot (CAL language); Data management; Selling your programs to companies; Legal File; the intricacies of copyright.

ISSUE 8 (Sept. 1983):

AMS 3 inch microdisks (review); **Computer Answers File No 1: Interfaces**; Making 3D images; WordStar Workshop (part 4); dBase II Workshop; Numbers; Recursion; Game of Life; Programming logic statements; Data compaction; **Apple Clinic;** Microsystem's insides; BCPL (language); Spreadsheet formulation; mircos in schools; Abstract computer Art; High street retailers; Legal file: the cost of going to court.

ISSUE 9 (Oct. 1983):

Colne's Armdroid robot (review); Advanced VisiCalc; Coping with cassettes; Tandy 100 versus Epson HX20; Translating Basic into Assembler; Data Programming; WordStar Workshop (part 5); dBase II Workshop (part 2); Bill Budge interview; True Random Number Generation;

Logo (language); **CP/M Clinic;** Probing the processor; micro-designing computer; database reviews; Spreadsheet formulation; computerised graphics on Rock albums; Disk prices; Legal File: customer/dealer disputes.

ISSUE 10 (Nov. 1983):

ACT Apricot (review); Hard disks (overview); The Sord M5/CGL M5 (review); Spectrum expansion (add-ons); Vic port project (Rs232 card); Break into Barcodes; Getting RAM; Wordstar Workshop (part 6); **Tandy, Dragon, Genie Clinic.**

Memory Mapping; Peripheral chips; MSX Compatibility; War games (reviews); An Epson in Turkey (roadtest *exotique*); Keyboard trainers; Computer training courses; Brixton ITeC (Econet); Buying second hand systems; Legal File (problems of setting up a software library).

ISSUE 11 (Dec. 1983):

New generation of cheap modems; printer buffers; Watford Electronics disk filing system; Disk benchmarking test; Mice-like inputting devices; Communications software; Using arrays; Seymour ('Logo') Papert (interview); Programmers Workshop ('Wolf Fence Algorithm' / 'Instrumentation'); Worms; **Sinclair Clinic**; Device drivers; Bulletin boards; dBase version 2.4 (d'Base III'); Spreadsheet DIF facility; Choosing a user group; Correspondence course in computing; GOSH — the Guild of Software Houses; Legal File: options on going to court.

(Also incorporating the ***Computer Answers* Upgrade Supplement** (gratis), which contains full information on the upgrading possibilities of the 13 most popular microcomputers.)

ISSUE 12 (Jan. 1984):

Elan Enterprise; Atari 600XL; Spectravideo; Cheap daisywheel printers; Best games of '83; Personal CP/M; Converting one Basic into another; **BBC/Electron Clinic** Cassette editors and assemblers; Games programming with sprite graphics; Bank Street Writer word processor; Reflexive VisiCalc; Start your own user group; Furniture to keep your micro tidy.

(Incorporating 'Program Power' booklet (gratis) containing listings for all the popular micros).

ISSUE 13

(Feb. 1984):

Inside Oric ROM, IBM PC jr; Joysticks; scope (games writer); Instructional games videos; special effects from dot-matrix printers; Interface 1 problems; Beyond Basic; Getting Sound Effects; Game of Go (Part 1); Game of Nim (Part 1); Programmers Workshop: speeding up;

Commodore 64/Vic 20 Clinic; Microcache package; Business databases; Everyman database package; Disk corruption; Cassette duplication; Second-hand peripherals; Setting-up a bulleting board; Legal File; seoncdhand micro sales.

ISSUE 14

(March 1984):

Memotech MTX; Dragon 64; Vic 20 add-on boards, adventure game writing packages; fancy fonts for the BBC; RS232 interface revealed; Bluff (game); Go (Part 2); BBC disk file expansion; Nim (Part 2); Fog Index (game); Wordwhizz (game); Assembler Workshop; Basic Workshop; **Spectrum / ZX81 Clinic;** Operating systems; Business: accounts packages; accessible mega-databases; weekend training course.

Introducing *Computer Answers* Bulletin Board-CABB — our very own, free electronic magazine; Legal File — what are the pros and cons of buying a micro with a credit card.

ISSUE 15

(April, 1984):

Sinclair QL; Apple Macintosh; Disk drives; programming by video; Tactical computer war games; Spectrum graphics packages; VDU conversion; Documentation; Data compaction; Atari Graphics modes; Oric synthesizer; Four-sight game; Philip '*The Hobbit*' Mitchell interview; screen display storage;

BBC/Electron Clinic; Operating systems (Part 2); Using your micro to make money; *Brainstorm* 'ideas processor'; *Starburst* and *Starindex* data management packages; Micro repair sources; Legal File; up-market micro deals.

ISSUE 16

(May, 1984):

New generation of Japanese MSX micros (Part 1); Transam Wren (review); New range of high-quality dotmatrix printers; Upgrading to disk drives; Hurg games designer; Motorola 68000 chip; Commodore interactive *Battleships;* Spectrum animation techniques; Guide to the Dragon's 6809 processor; *Crocus* — crossword solving program; BBC program security;

Commodore 64/Vic 20 Clinic; Operating systems (Part 3); Micro system cleaning products; Legal File: software houses' case.

ISSUE 17

(June, 1984):

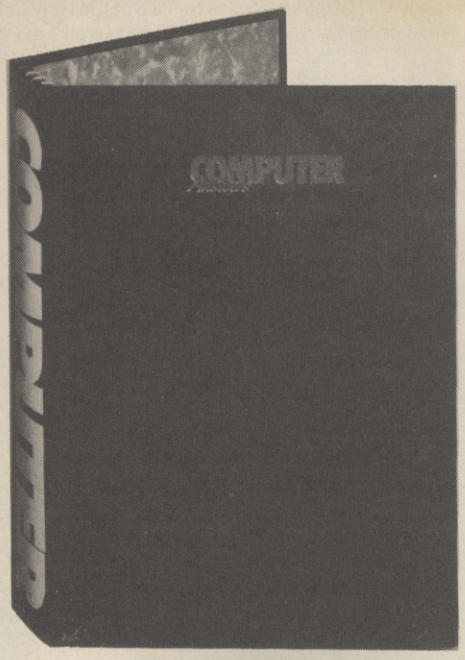
Japanese MSX micros (Part 2); BBC add-on boards; Cheap modems; Cheap CP/M; Program testing techniques; Creating your own adventure routines; Spectrum animation techniques (Part 2); Spectrum sound effects techniques; *Towers of Hanoi* (game for the 48K Spectrum); *Reversi* (game for the Spectrum); Converting Vic programs to run on the 64; Assembler Workshop;

SuperClinic: masses of Q&As on the Spectrum, BBC, Commodore, Oric and Dragon machines, including articles on Dragon Pascal and Oric hires graphics; Backup and archiving (*Clip* package); Wiring up your own connecting leads; Operating System tables (appendix); Legal File: advantages of 'under-age' software authors.

ISSUE 18

(July/Aug 1984):

Robot arms and servo-controllers; PC Junior Creview); Amstrad (review); *Homeword* word-processing package; radio software; MIDI System; Incorporating dialogue into your adventure games; C language; techniques for getting the PRINT AT function on the Vic 20 and Commodore 64; Syllogism program; Basic Workshop: programming idioms; **Sinclair Clinic**; database packages; *Everyman* revisited; Software piracy; stationery supplies; Legal File: what to look out for when signing contracts.



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